ELECTRICAL CONSTRUCTION AND MAINTENANCE

JANUARY · 1950

OUTLOOK FOR '50

Forecasting the market potentials in electrical construction, installation and modernization through the new year.

Also

how to estimate electrical work, a new series; inspection methods; wiring a hundred ranges in five hours; and how contractors are pushing planned lighting.

A McGRAW-HILL PUBLICATION

A very important part of
a fluorescent lighting installation
is the *Ballast*

When buying fluorescent fixtures
make sure you get
a good *Ballast*

. . . get a G-E *Ballast*

. . . insist on this tag

A copy of G.E.'s new booklet "Quality Costs Less" is yours for the asking. It shows with actual figures how the longer lamp life, greater lamp output, and longer fixture life that you get with a General Electric ballast, means dollars in your pocket. Write Section 412-83, Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

412-83

Listed by Underwriters' Laboratories, Inc.

Do *Your* "20 Amp." Circuit Breakers Carry 20 Amps. Continuously?

Even in

COMPACT PANEL BOXES?

OVERHEATED ROOMS?

DIRECT SUNLIGHT?

NOT if they trip by Thermal Elements!

Insist on Murray FULLY MAGNETIC Circuit Breakers...

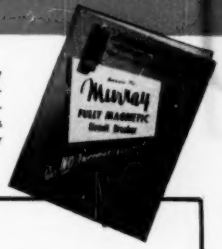
NO Thermal Element	**ALWAYS** Carry Rated Load Continuously
NOT Affected by Heat	**ALWAYS** Carry Harmless Temporary Overloads
NO False Tripping	**ALWAYS** Trip Instantly on Dangerous Overloads
NEVER Need "Derating"	**ALWAYS** Can Be Reset Immediately After the Overload Passes

This 8 circuit load center comes with 4, 6 or 8 Murray *Fully Magnetic* Breakers. Also available are 2 circuit and 4 circuit load centers.

Single pole breakers in 10, 15, 20, 25, 30, 35 and 50 amp. ratings. Only two handle positions — Off and On.

Each breaker can be *individually* replaced with breaker of same, lower or higher rating.

Get the full facts on Murray *Fully Magnetic* Circuit Breakers. Operating characteristics and construction features are given in this informative folder. Write for your copy now.



FOR TOMORROW'S LOADS...
Equip Today!

FULLY MAGNETIC

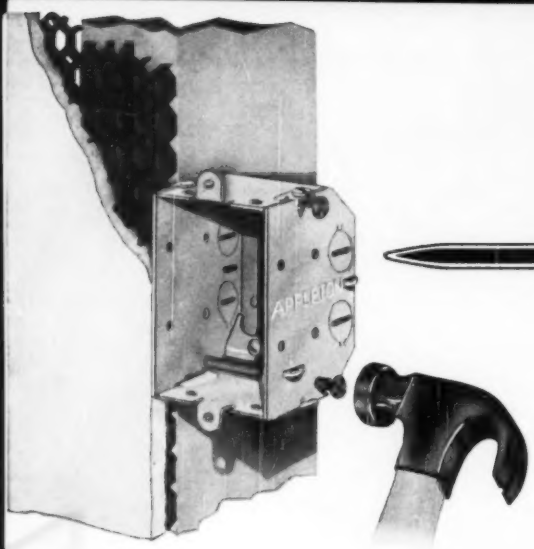
Murray

MANUFACTURING CORPORATION

50 Years of Service to the Electrical Industry

1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

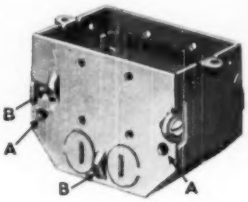
SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS
SWITCHES • CURRENT LIMITING REACTORS • CROWS'NEST AERIAL LADDERS



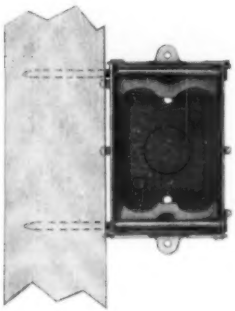
NAIL these APPLETON Switch Boxes direct to studding

QUICK . . . ECONOMICAL
WHERE SPEED AND ECONOMY COUNT

Side View Shows Nail Holes, (A) Leveling Ridges (B)



Leveling Ridges Assure Perfect Alignment



Here are sturdy, adaptable Appleton Switch Boxes, now modified to include nail holes for faster, firmer mounting. Besides easing your installation job, these special nail holes eliminate the need for mounting brackets, thereby reducing overall costs.

Each side of these boxes is equipped with leveling ridges—scientifically spaced to bite evenly into wood, line up box with studding, accurately, permanently.

These Appleton Switch Boxes are available in the exact type and size for your requirements for use with non-metallic sheathed cable, armored cable and rigid conduit. For the best in switch boxes—for any electrical fitting—specify Appleton—Standard For Better Wiring.

Write for complete catalog information

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

With which is consolidated Electrical Contracting The Electragist and Electrical Record . . . Established 1901

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... reducing copper losses

... increasing current capacity

... prolonging insulation life

HERE'S HOW to reduce copper losses ... increase current carrying capacity ... and prolong insulation life—run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

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JM

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%
Earth Temp. ambient—20 C

	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric Loss (C)	1.9	2.1
Allowable Rise for Copper Loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365.
Allowable Current—(Relative %)	105.6	100.

Johns-Manville *Transite Ducts*

"KORDUCT"— for encasement in concrete

"CONDUIT"— for use exposed and underground without encasement

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Put DRY-TYPE TRANSFORMERS in Load Areas

- Reduce Power Consumption
- Improve Machine and Lighting Efficiency
- Increase System Flexibility
- Reduce Cable Installation Costs

IN THE PLANT LAYOUT above, note the effective use of dry-type transformers. Installed at load centers, they eliminate long secondary runs, thus minimize distribution losses and improve voltage regulation. This in turn means stepped up machine and lighting efficiency.

To get these advantages for your system, specify Allis-Chalmers dry-type transformers. These safe, compact units give you the *additional* advantages of 1) faster hookup by means of clamp type connectors or convenient drop out plates, 2) *Spra-Bonderized* rust protection, and 3) heat-and-moisture-resisting *Fiberglas* insulation which cuts down size and weight, makes for easier mounting *anywhere* Ratings from 1½ to 300 kva.

For full information, contact your local A-C sales office. Or write for bulletin B6382.

A-2806

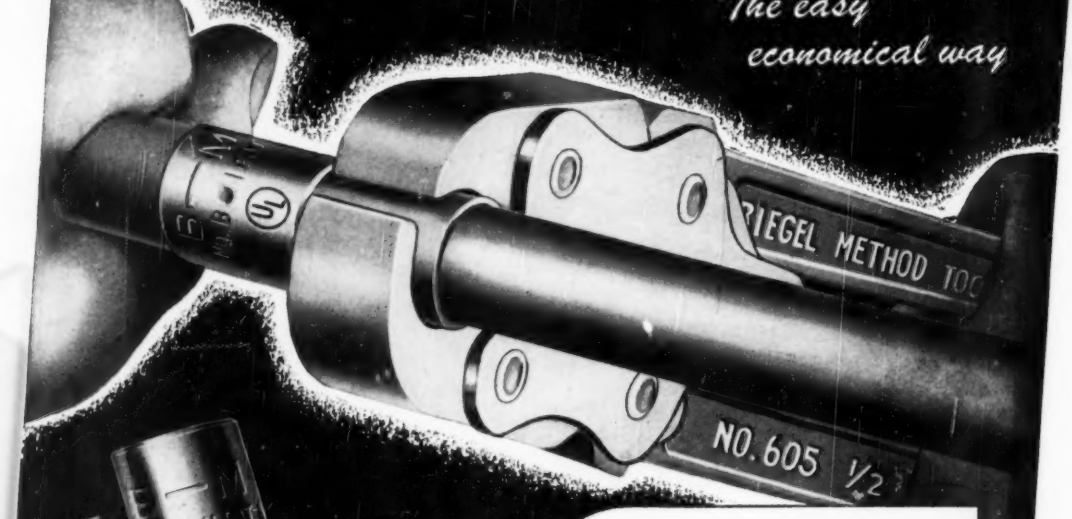
ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

Get CORRECT CONDUIT CONNECTIONS

The easy economical way



Cross Section Showing Indentations

• NEATER • STRONGER • FASTER • APPROVED

All B-M Fittings Carry the Underwriter's Seal of Approval and Canadian Standards Ass'n Approval No. 9296

Select the best, insist on Briegel All Steel Fittings, the original approved Indenter type connectors and couplings for thin wall conduit tubing. You will not only find that Briegel Indenter Fittings are easier and faster to use, but also make neater, stronger connections, the correct connections. Two Easy Squeezes and they're set. Start using Briegel Fittings today. Have more satisfied customers—more profits from each job.

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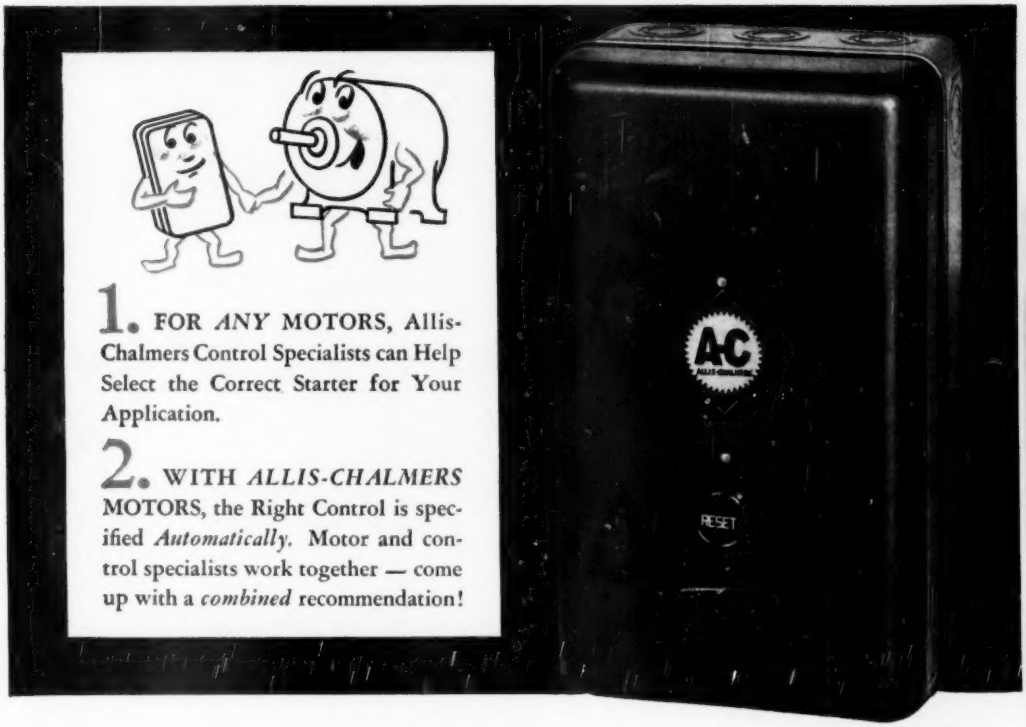
Get this COORDINATED Motor-Control Service!



1. FOR *ANY* MOTORS, Allis-Chalmers Control Specialists can Help Select the Correct Starter for Your Application.

2. WITH *ALLIS-CHALMERS* MOTORS, the Right Control is specified *Automatically.* Motor and control specialists work together — come up with a *combined* recommendation!

RESULT: YOU'RE DOUBLY SURE that important starter details like type, size, enclosure, and protective devices are the *best* for your motor application!

Whether you're in the market now for motors and starters, or starters alone... check the *complete* Allis-Chalmers line.

HERE ARE FEATURES YOU'LL GET IN SIZE 0-3 MAGNETIC STARTERS:

▸ Roomy enclosures and clearly marked terminals are easy to wire. ▸ Shading coils eliminate alternating current hum. ▸ Enclosed chambers confine arcing. ▸ Double-break silver to silver contacts and other replaceable parts are easily accessible.

For *any* motor . . . Squirrel-Cage, Wound Rotor or Synchronous . . . Allis-Chalmers offers controls coordinated to your needs. For manual or magnetic across-the-line starters, standard or special purpose starters... resistor, reactor, or auto-transformer reduced voltage starters . . . call your nearby A-C Authorized Dealer or Sales Office today.

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MILWAUKEE, WIS.

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Applied . . .
Serviced . . .

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MOTORS — ½ to 25,000 hp and up. All types.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.

PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

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"You can control any motor with an Allis-Chalmers motor starter."

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DUTCH BRAND PLASTIX

ELECTRICAL TAPE

packaged 5 rolls to usable container!

MADE BY SPECIALISTS IN THE MANUFACTURE OF ELECTRICAL TAPES FOR FORTY YEARS

DUTCH BRAND PLASTIX ELECTRICAL TAPE is superthin in construction but high in dielectric resistance; it is used in those many places where space is limited. It stretches and conforms readily to irregular surfaces... stands up under severest conditions... resists water, oil, acids, alkalies and corrosive chemicals.

DUTCH BRAND PLASTIX ELECTRICAL TAPE is the result of careful study and research and meets the recognized high quality standards established by all other DUTCH BRAND electrical tapes.

For complete satisfaction order DUTCH BRAND PLASTIX ELECTRICAL TAPE by name.

FEATURES THESE MANY OUTSTANDING QUALITIES

TEARS READILY... **in spite of its strength and stretch.**

CONFORMS TO IRREGULAR SURFACES... **superthin, great flexibility and stretch make excellent conformity.**

RESISTS WEATHER... **rain and rough weather do not affect it... favorably withstands relatively high or low temperatures.**

RESISTS ACIDS, ALKALIES, CORROSION ...wherever present... **In chemical plants, around machinery, etc.**

EXTRA-HIGH DIELECTRIC RESISTANCE... **a single thickness resists 8000 volts which is greater than 1000 volts per mill of thickness.**

EXCELLENT ADHESION... **the quality of the adhesive and the even coating assure excellent adhesion.**

TENSILE STRENGTH... **it is strong... has ample strength for all types of applications.**

MADE WITH "KNOW HOW" AND UNDERSTANDING OF ELECTRICAL REQUIREMENTS

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DUTCH BRAND

VAN CLEEF BROS. INC.

Manufacturers... Rubber Products... Est. 1910

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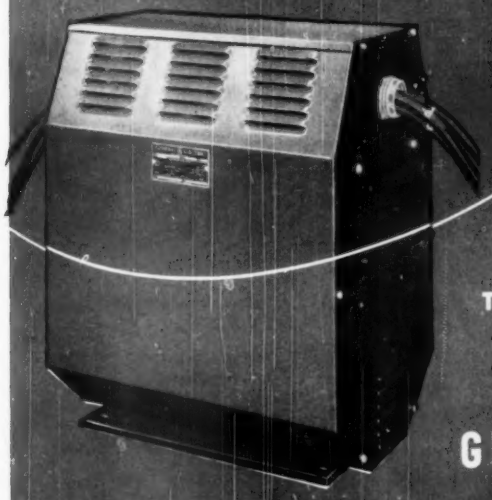
for the Right Voltage at the Right Place

Serving lighting and small power loads directly from power circuits—*at* the load—can mean real savings. It means lower line losses, reduced wiring costs, higher efficiency—and often lower power costs. General Electric's M and D dry-type transformers are ideal for this purpose—for supplying the *right voltage at the right place.* Small and compact, they require no fireproof vaults, are easily and quickly installed, are quiet in operation, and will give you a lifetime of reliable service. They require practically no inspection or maintenance.

All M and D ratings are available for quick delivery—many standard ratings from stock. See your local electrical jobber now, or call the nearest G-E Apparatus Sales Office. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

TYPE M

. . . for requirements calling for 0.25 to 10 kva ratings; indoor or outdoor use.



Dry-Type Transformers

TYPE D

. . . for ratings of 15 kva and up; for indoor service.

GENERAL ELECTRIC

411-62

Buy One

MOTOR STARTERS
with the
'Strongbox' Magnet Coil

All the best features in popular sizes for motors to 50 hp. See for yourself. Get a new General Electric Motor Starter. Get out your screwdriver. And get the facts. Make your own comparison on these big ALL-NEW features:

STRONGBOX MAGNET COIL – Coil is locked in a tough block of plastic.

NEW ARC HOOD – Molded, burn-resistant arc hood snuffs arc immediately.

NEW CONTACTS – Large silver contacts with plenty of contact pressure give long life. Convertible from normally open to normally closed in size one and smaller – without additional parts.

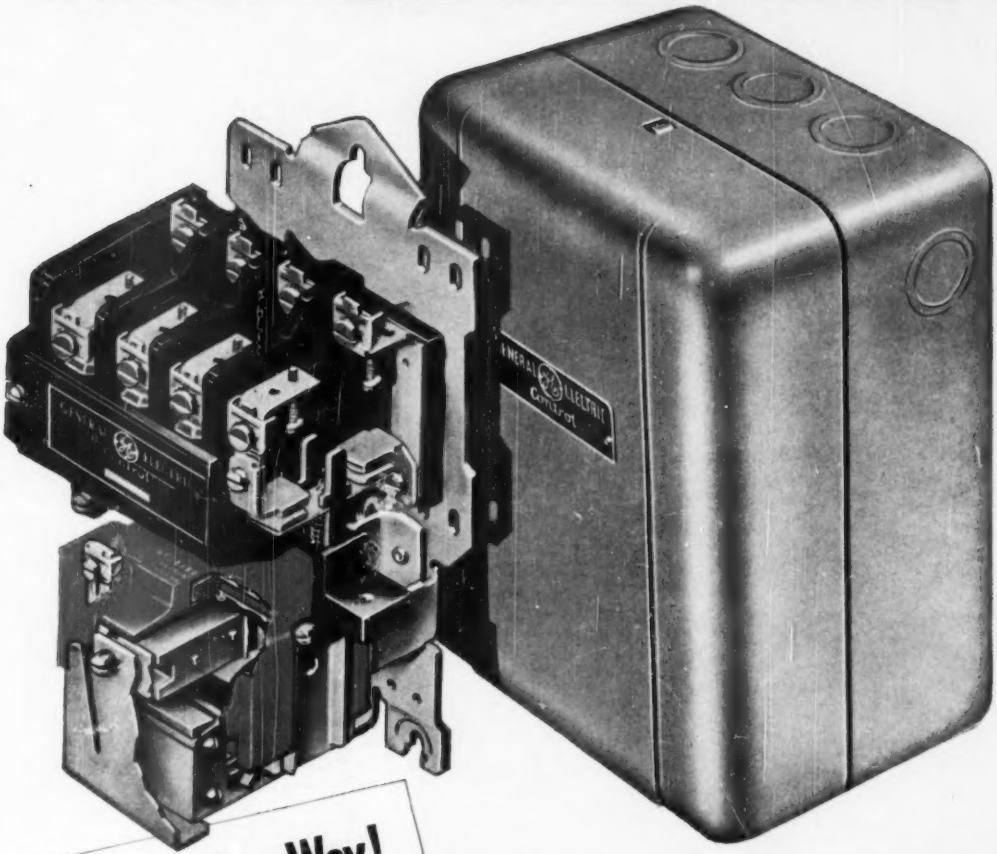
NEW MAGNET – Quick direct action, large striking surface.

EASY TO INSTALL – EASY TO MAINTAIN – See how easy it is to get at the ALL-NEW General Electric starter. Note, too, that it's built to take the punishment of day-in, day-out use with a minimum of maintenance. Check the wiring space inside the case. Check the terminal clamps that make installation fast. Check the ease with which controls can be inspected.

DESIGNED FOR FAST ACTION – BUILT FOR LONG LIFE – From the tough STRONGBOX magnet coil to the high strength arc hood, all parts of the new General Electric Motor Starter are built to last. In the revolutionary G-E design, the plastic coil enclosure also serves to guide the armature. For fast, positive action the tough plastic block is impregnated with a permanent lubricant – molybdenum sulphide. Channel-reinforced magnet guides slide smoothly for quick action at all times. Bimetallic thermal relays give swift protection.

GENERAL ELECTRIC

and COMPARE



Order this Easy Way!

Look inside. Make the screwdriver comparison test. Inspect the many new features, and we're sure you'll be enthusiastic. Just fill in the coupon at the right and we'll send you the starter immediately. Or, if you prefer, we'll be glad to send you the new, free, tell-all booklet "Look Inside and Compare" that gives more detailed information.

General Electric Company, Apparatus Department
Section A676-281, Schenectady 5, N. Y.

Send me one of the NEW CR7006 starters (size 1, 3 pole, enclosed). List Price $22.00.

_____ Check Enclosed. (Add any state or local sales or use taxes)

_____ Purchase order attached; bill to our account with: _____

_____

_____

(Name and address G-E sales office or G-E distributor.)

Motor Horsepower Rating (check one)

☐ 3 ☐ 5 Horsepower at 220 Volts
☐ 3 ☐ 5 ☐ 7½ Horsepower at 440 Volts
} 60 Cycles, 3 Phase

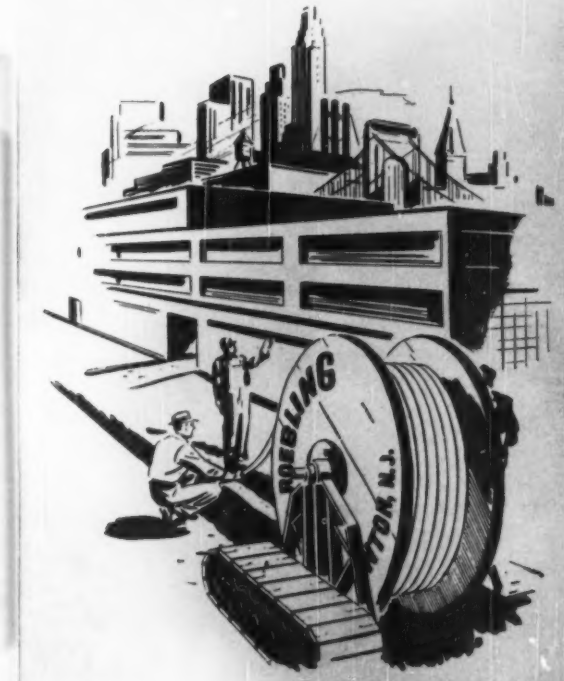
Approx. Motor Speed ☐ 1800 RPM ☐ 3600 RPM ☐ 1200 RPM

Name _____

Address _____

City _____ **Zone** _____ **State** _____

Today it's Roebling!

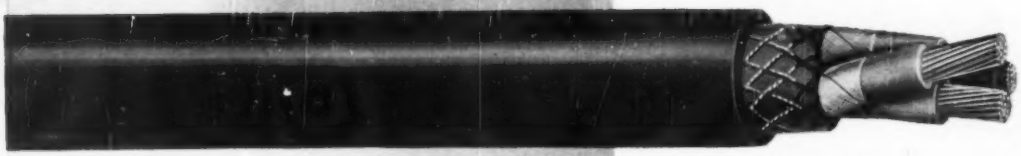


Why men who watch costs specify Roebling ROEPRENE Parkway Cable

THERE'S ONE BIG and deciding reason for choosing Roebling ROEPRENE Parkway Cable . . . it enables you to avoid the expense of underground duct systems! This cable is made for direct underground installation. Only a two- or three-foot trench is needed. And as soon as the cable is out of sight, you can put it out of mind. There'll be no service troubles from wind or weather . . . safe physical protection is assured by the non-metallic armor of a ROEPRENE sheath.

Roebling ROEPRENE Parkway Cable has rapidly become a top choice for series street lighting, parkway boulevard lighting, traffic signal, fire alarm, flood lighting, railroad yard, signal and many other circuits. It is available in single and multiple conductor types—solid or stranded—in a range from 600 to 5,000 volts.

Have your Roebling distributor or Roebling branch office help select the best cable for your special needs. John A. Roebling's Sons Company, Trenton 2, New Jersey.



From copper rod to finished cable all components of Roebling electrical wires and cables are manufactured in Roebling's own plants. Painstaking care, research, engineering and modern precision machines are your assurance of highest quality.

ROEBLING

A CENTURY OF CONFIDENCE

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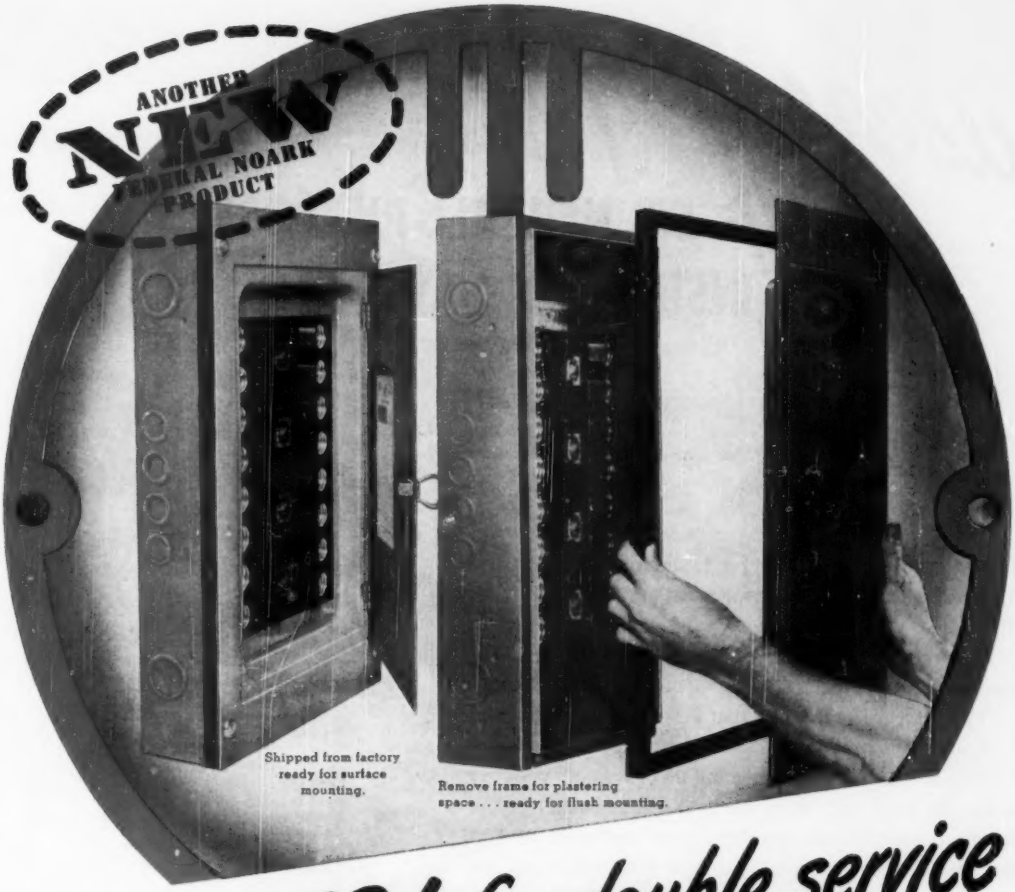
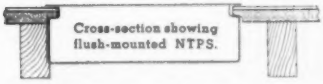

ANOTHER
NEW
FEDERAL NOARK
PRODUCT
Shipped from factory ready for surface mounting.
Remove frame for plastering space . . . ready for flush mounting.

FRAMED!-for double service

Every new Federal Noark NTPS Panelboard can be flush or surface mounted



THIS SIMPLE FRAME—shown in red—makes every new Noark NTPS Panelboard enclosure a "combination enclosure" for either flush or surface mounting. Now you can afford to carry your own stock of NTPS Panelboards . . . a real time and money-saver.

New Noark NTPS comes to you with frame positioned in walls of enclosure directly behind cover . . . and cabinet is ready for *surface* mounting. For *flush* mounting, remove and discard the frame—no tools needed—and thus provide ample space for plastering.

The Noark NTPS Panelboard line has been expanded and includes 4, 8, 12, 16 and 20 circuit models. It is the largest-selling low-price line of toggle switch panelboard on the market today . . . and the smartest in appearance, too.

Boost your sales and profits with the new Federal Noark NTPS Panelboards. Order them from your distributor. Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.

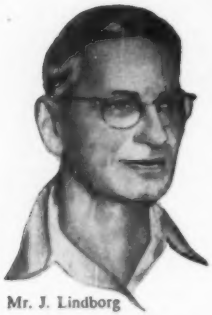
FEDERAL NOARK

FEDERAL NOARK NTPS PANELBOARD

Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

users say

G. E.'S NEW ALL-PURPOSE* INSULATING VARNISH G-E 9574



Mr. J. Lindborg

From all parts of the country, enthusiastic reports are pouring in from users of G. E's new general-purpose varnish G-E 9574.

Here's a typical statement from J. Lindborg, owner and operator of AAA Electric Motor Service, Atlanta, Ga.

"Our experience has been that this varnish is as good as G. E. claims. It gives a good coat on every type of wire, bakes easily and dries to a tough coating that stands up perfectly in service. Also, this varnish works excellently with all types of coated wire and does not damage the insulation. We like the thinner, petroleum spirits, since it is cheap and can be purchased locally.

"During the two years we have been using this varnish we have had no complaints from any of our customers concerning our work."

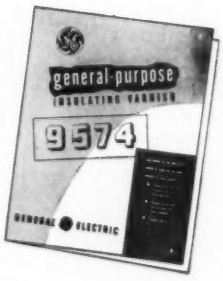
...*"bakes easily"*

...*"on every type of wire"*

...*"stands up perfectly in service"*

IF YOU HAVEN'T YET TRIED G-E 9574,
your local G-E Distributor, or write for our new bulletin to Chemical Department, General Electric Company, Pittsfield, Massachusetts.

*G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G. E.'s complete line of electrical insulating materials.



You can put your confidence in

GENERAL ELECTRIC

CD49-M8

GREAT NEWS FOR CONTRACTORS . . .

THE POWDER-ACTUATED FASTENING TOOL *Comes of Age*

After Months of Laboratory Experimentation . . . After Thorough "On-the-Job" Testing . . . We Proudly Present the New and Amazing DRIVE-IT "300" the Powder-Actuated Fastening Tool Our Customers Asked For.

THE BIRTH OF THE DRIVE-IT IDEA

Three years ago Powder Power introduced the most revolutionary and efficient fastening method known. It was the DRIVE-IT powder-actuated tool . . . a tool that utilized a small power charge and a hardened steel "drive-pin" to fasten steel or wood to concrete or steel. Fastening with this tool was a split-second operation—eliminating the drudgery of drilling or hammering—saved contractors hours of time and thousands of dollars. In short, it was a bonanza for everybody

who had a steel or wood to concrete fastening problem. Thousands bought DRIVE-IT tools and letters of praise for their money-saving effectiveness flooded in.

PRESENTING . . . THE NEW DRIVE-IT "300"

Months ago our engineers went to work to design an *entirely new* and *better* powder-actuated tool . . . one which would embody all of the features our customers asked for. The result is the DRIVE-IT "300".

Here it is . . . it's ready for you NOW. Check these features and you'll realize why we say: "The new DRIVE-IT "300" is the *only* truly modern, efficient and *safe* powder-actuated tool on the market!"

1. POSITIVE 3-WAY SAFETY.
   1. Permanently attached, adjustable safety pad. Can be used in restricted places.
   2. Cannot be fired accidentally. Tool must be depressed against *solid surface* to be fired.
   3. No hitting or lunging to fire—a twist of the wrist does it . . . *automatically!*
2. "CONTROLLED POWER" with *one* power charge. No need to buy 4 or 5 different charges.
3. 40% MORE POWERFUL than any other "22" tool. More power means deeper penetration, greater holding strength, more versatility.
4. AUTOMATIC EXTENSION BARREL for tight places—no need for extra, expensive extension barrels.
5. LIGHTWEIGHT. Tool weighs only 5 lbs. 10 ozs. Makes overhead work easy. Can use for hours without tiring effects.
6. LESS NOISE. Tool is much quieter in operation—easy on the nerves.
7. FLANGELESS DRIVE PINS. Easier to handle—cheaper to buy. No "ring" to dig out of tool after firing. No area exposed to corrosion on plated pins after driving.

There it is, mister! A powder actuated tool with the "bugs" out. One that can save you up to 75% in fastening costs and *still* keep your workers happy. Do yourself a favor and send for the whole story *today!*

DON'T DRILL IT— DRIVE-IT POWDER-POWER TOOL

Distributors Coast-to-Coast

POWDER POWER TOOL CORPORATION

0702 S. W. Woods Street • Portland 1, Oregon

Canadian Distributors: AMMO-POWER TOOL CO., LTD.
Foot of McLean Drive, Vancouver B. C., Canada

Sure I'm interested . . . Send me the story! Quick!

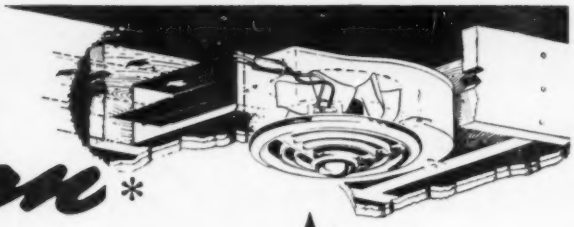
NAME_____

COMPANY_____

STREET AND NO._____

CITY AND STATE_____

POWDER POWER TOOL CORPORATION, 0702 S. W. WOODS STREET, PORTLAND 1, OREGON



Blo-Fan*

IS superior!

IN THE KITCHEN—Blo-Fan installs over the range, where it will whisk out steam, grease, and cooking odors as they rise before they spread.

IN THE BATH—Blo-Fan quickly expels steam from the bathroom—avoids foggy mirrors and steam-streaked walls—the air stays crisp and fresh.

IN THE GAME ROOM—Blo-Fan eliminates tobacco and other odors by removing stale air before it contaminates the drapes and furnishings. No morning-after odors.

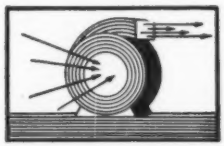
IN THE LAUNDRY—In any weather Blo-Fan keeps the laundry clear and fresh. Steam is expelled before it spreads, windows do not fog...air is kept dry and crisp.

Spot Ventilation at the point of Air Pollution

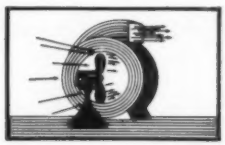
*Trade Mark Reg.

HERE'S WHY!

FAN—75% of the air moved by a breeze fan is thrown from the blade tips. The center is weak when it meets resistance. A fan delivers volume, but it lacks power.



A BLOWER draws a smaller amount of air into the vortex, discharging it with great velocity, thus overcoming resistance. A blower delivers power, but it lacks volume.



Blo-Fan combines the volume of a fan with the power of a blower. The fan blades feed the vortex of the blower so the vanes are fully loaded. That's why Blo-Fan delivers more air with more power.

Manufacturers of
PRY-LITES
. . . the modern recessed lighting fixtures with snap-on fronts.

Factories: Pomona, California; Newark, New Jersey
Warehouses: Los Angeles, San Francisco, Chicago
Stocked by more than 500 wholesalers in more than 350 cities

Pryne & Co., Inc. Box E-1, Pomona, California

CRESCENT
SYNTHOL BUILDING WIRES

TYPE TW
For Both Wet and Dry Locations

FOR BETTER WIRING

Simplify Your Stock Problem

USE THIS ONE TYPE FOR ALL YOUR BRANCH CIRCUIT REQUIREMENTS

CRESCENT SYNTHOL — Type TW, Building Wires and Cables are insulated with a special, tough, thermoplastic compound that results in wires of unexcelled Permanence, Safety, Adaptability and Value. They combine high dielectric and mechanical strength with the following desirable features.

SMALL DIAMETER—has smallest outside diameter for same conductor size, permitting more conductors, or larger conductors in same space.

FLAME RETARDING—SYNTHOL insulation will not support combustion.

LONG LIFE—practically unaffected by continuous exposure for years to sunlight or air; more stable than any rubber insulation.

RESISTANT to moisture, acids, alkali and most chemical solvents.

OILPROOF — cutting oils, greases and petroleum solvents do not injure SYNTHOL.

BRIGHT COLORS — non fading, the insulation is the same color throughout so color will not scrape off; easily cleaned; twelve colors.

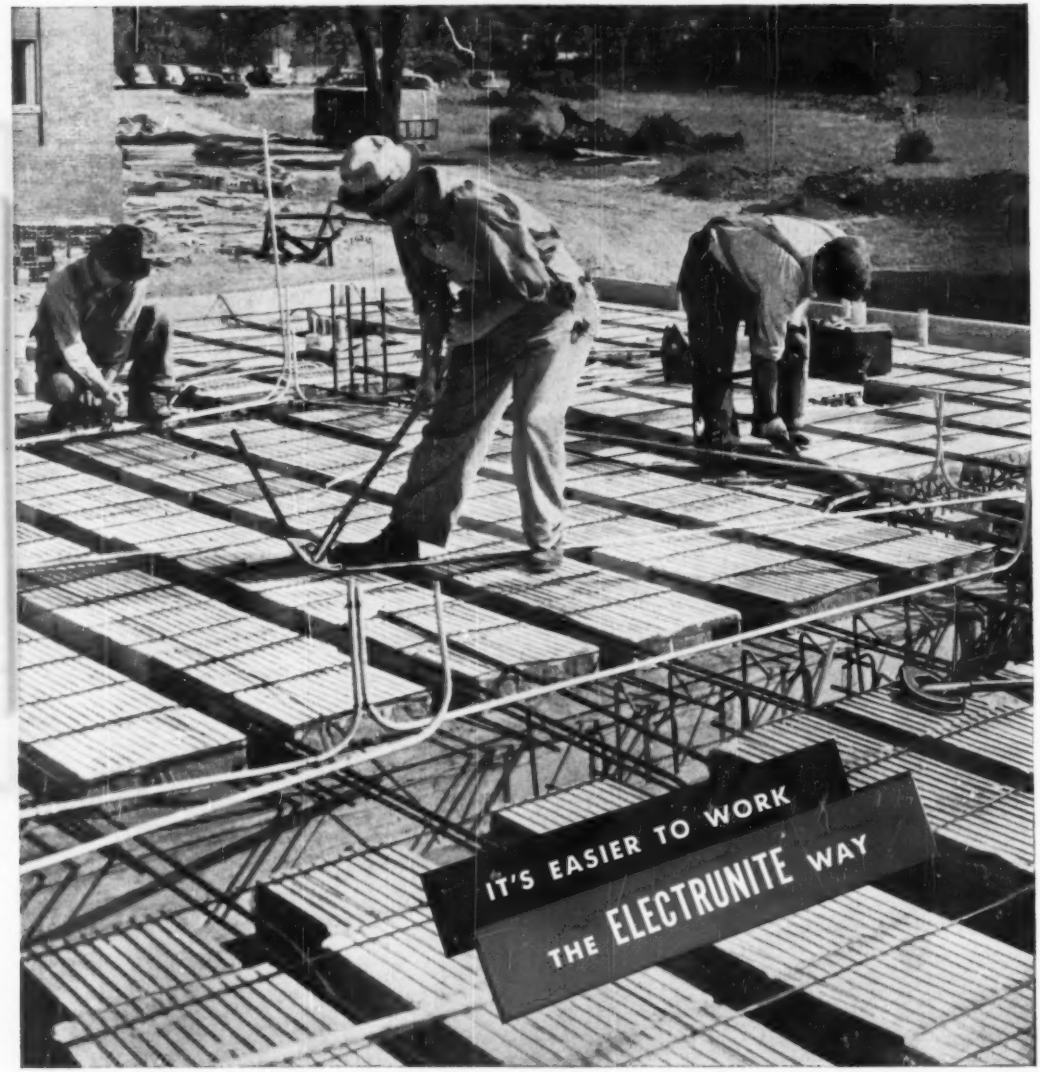
FREE STRIPPING—makes splicing and soldering easier and faster.

EASY PULLING—because SYNTHOL wires have a permanent clear wax lubrication on their hard, smooth, abrasion resistant surface.

CRESCENT
WIRE & CABLE
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

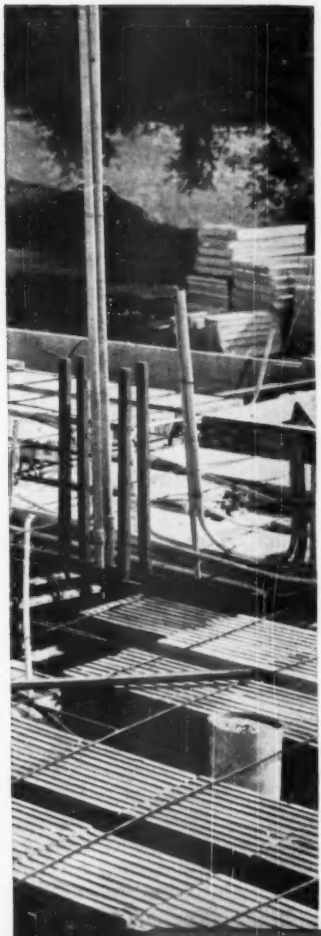
ELECTRUNITE

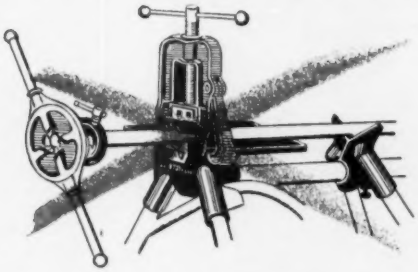
PROVIDES RIGID STEEL PROTECTION



—THE *Original* E.M.T.

WITHOUT THREAD-CUTTING PROBLEMS





● There's no need for pipe vise, thread chasers or other "plumbing" tools, when your men use Republic ELECTRUNITE E.M.T.—the *electrician's* raceway for modern, dependable wiring protection.

Because ELECTRUNITE E.M.T. is *threadless,* it's ready to use when it arrives on the job . . . one minute with a hacksaw, and cut lengths are ready to be installed. Strong, vibration-proof, compression couplings make water-tight joints in a matter of seconds . . . eliminate the need for turning long lengths of tubing into fittings.

With ELECTRUNITE E.M.T., that's only part of the story, too. Inch-Marking* and Knurled Inside Surfaces combine with light weight and simplified bending to make this the easiest-to-install rigid steel raceway in existence. For complete information about ELECTRUNITE E.M.T., see your nearest ELECTRUNITE Distributor, or write direct to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, New York

*Reg. U. S. Pat. Off.

REPUBLIC STEEL

Republic
ELECTRUNITE E.M.T.

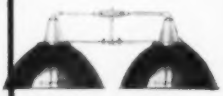
LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

CONTENTS: ● Fundamentals and Benefits of Planned Lighting ● How to Appraise Lighting Equipment ● How to Analyze the Seeing Task Table of Recommended Footcandle Values ● How to Select one of the 12 Lighting Systems ● How to Locate Lighting Units ● Lighting Layout Suggestions ● "Short-Cut" Tables of Footcandles Obtained ● Selection of Special Service and Supplementary Units.

SYSTEM 4

High Narrow-Bay Concentrating Units

Individually-spaced incandescent system for providing illumination levels from 20 to 50 footcandles.



SYSTEM 5

High-Bay Combination Units

A system of combination mercury and incandescent units for providing illumination levels from 20 to 50 footcandles.

SYSTEM 7

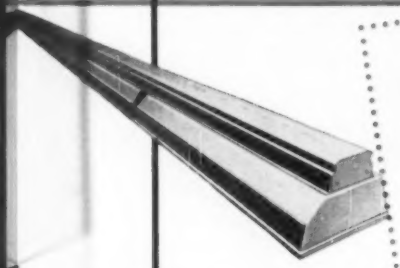
RLM "Shield-Flo 40"

A system of individually-spaced, specially shielded, closed-end fluorescent units, providing from 20 to 50 footcandles.

SYSTEM 10

"Magna-Flo 75"

A high light output system of fluorescent units, providing from 40 to 70 footcandles.



NEW BENJAMIN MANUAL Shows How You Can Employ The 12 Benjamin Lighting Systems To INSURE GOOD PLANNED LIGHTING

SYSTEM 11

"Lite-Line" System

A continuous channel system of fluorescent units, for providing illumination levels from 50 to 100 footcandles.

This manual brings you the principles and data needed to develop good planned industrial lighting installations. It shows you how to insure success of planned lighting through the proper application of the 12 basic Benjamin Lighting Systems.

These 12 Benjamin Systems enable you to meet, with a suitable lighting system or systems, the varied seeing tasks and environmental conditions involved in industrial lighting.

The Benjamin Manual of Lighting Application Data shows how the 12 systems can be used to provide required illumination levels from 10 to 150 footcandles; how they can be applied to specific lighting problems; how the use of the 12 systems, as outlined in the manual, simplifies planning and helps to determine the selection of the system or systems best suited to the specific requirements.

For your complimentary copy of this "Manual of Lighting Application Data," fill in and mail the coupon or write to:

BENJAMIN ELECTRIC MFG. CO., Dept. H, DES PLAINES, ILLINOIS

BENJAMIN ELECTRIC MFG. CO., Dept. H
DES PLAINES, ILLINOIS

Please send me, without cost or obligation, your Manual of Lighting Application Data to assist me in planning Good Lighting

Name_____

Title_____

Firm_____

Address_____

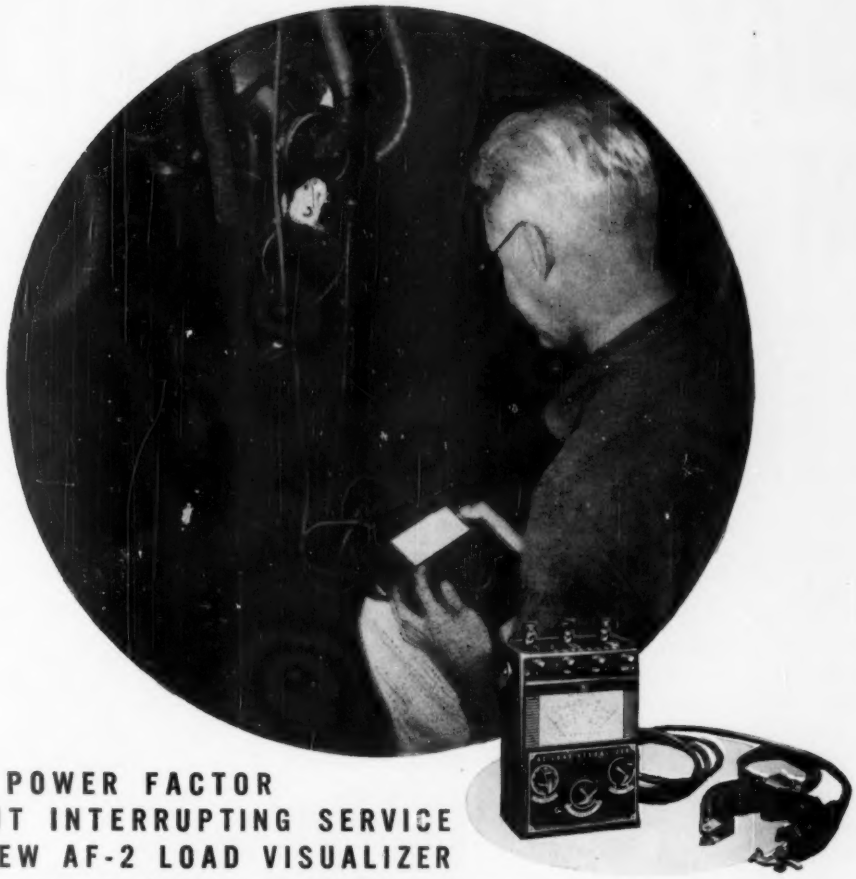
City_____

Zone_____ State_____

R-484

BENJAMIN
Lighting Equipment
Sold Exclusively through Electrical Distributors

1st STEP to lower power costs!



CHECK POWER FACTOR WITHOUT INTERRUPTING SERVICE WITH NEW AF-2 LOAD VISUALIZER

Does your power contract allow for reduced charges for high power factor? If so, improving power factor is a way to cut costs that's too good to miss. Also, improving the power factor gives relief to overloaded feeder circuits and transformers, results in better voltage regulation.

Now you can make the first step in improvement—checking present power factor—without cutting conductors or interrupting service. The whole job is done with the new AF-2 load visualizer and split-core transformer. It measures volts, line amperes, component amperes directly. Then power factor, watts, vars are read on a handy calculator.

For the full story, check your nearest G-E Representative—today. Or write for bulletin GEC-372. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

many applications

Testing Motors
Checking power and lighting circuits
Checking transformers
Or analyzing *any* a-c load

measures

Voltage **Current**
Power Factor
Watts **Vars**

GENERAL ELECTRIC

SPECIFY DAY-BRITE WITH CONFIDENCE

INSTALL DAY-BRITE WITH CONFIDENCE

DAY-BRITE QUALITY MEANS NO WORRIES

IT HAPPENS INVARIABLY. You're uneasy about fixture "X." Its ballast is questionable. In several places, construction is skimpy. But, maybe—just maybe—this time you'll be lucky. You go ahead with fixture "X."

BUT, SURE ENOUGH . . . the temperamental fixture skyrockets installation time. Your profits dwindle to a whisper. Then, add an irate customer . . . time and money lost in call-backs . . . and you're fed up with the whole electrical business.

THE ANSWER IS DAY-BRITE. No worries. No doubts. Every inch of every Day-Brite fixture is engineered and constructed to deliver fast, simple installation, lowest-cost maintenance and quality performance.

KEEP YOUR PROFITS. Keep your customers. Keep your peace of mind. Specify and install Day-Brite with confidence. You can't make a sounder "better business" policy.

08

"DECIDEDLY BETTER"

DAY-BRITE

Lighting Fixtures

Day-Brite Lighting, Inc., 5402 Bulwer Ave.
St. Louis 7, Missouri

In Canada: Amalgamated Electric Corp., Ltd.
Toronto 6, Ontario

DISTRIBUTED NATIONALLY BY LEADING ELECTRICAL WHOLESALERS

THE NEW DAY-BRITE "LUVEX" SLIMLINE FIXTURES

All-metal, shielded, for two 96" T-12 Slimline lamps . . . continuous or unit installations . . . suspension mounting only.

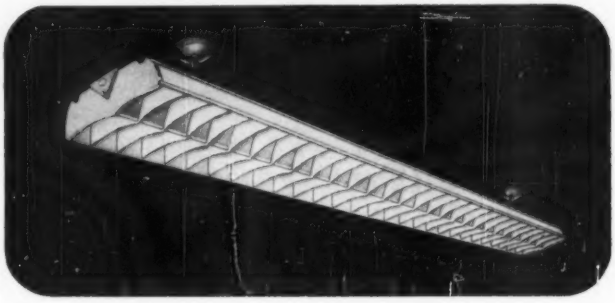
CHASSIS

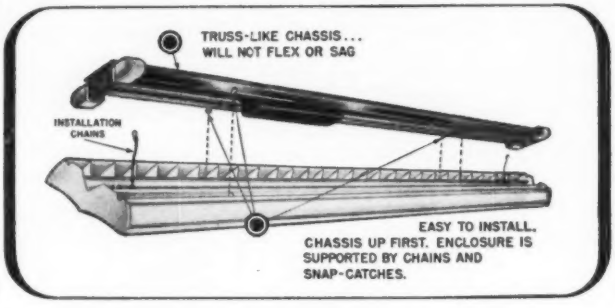
Rigidly engineered — no sagging — no flexing. Finished in HOT-BONDED SUPER WHITE enamel. Instant-starting HPF, 430 milliampere ballasts. Bushed openings in ends of chassis for through feed.

ENCLOSURE

Enclosure and louvers completely interlocked at all points, resulting in a rigid, one-piece unit. Finished in HOT-BONDED SUPER WHITE enamel. Amazingly simple, low-cost maintenance.

GET ALL THE "LUVEX" FACTS. WRITE TODAY FOR BULLETIN 10-M.




TRUSS-LIKE CHASSIS... WILL NOT FLEX OR SAG
INSTALLATION CHAINS
EASY TO INSTALL. CHASSIS UP FIRST. ENCLOSURE IS SUPPORTED BY CHAINS AND SNAP-CATCHES.

Need more power from your electrical circuits?

. . . a Kansas City firm boosted feeder capacity 31% by installing G-E capacitors

The experience of the Union Wire Rope Corporation of Kansas City, Missouri, illustrates how capacitors can help an expanding plant. The company needed to install more machinery. Its transformers and feeders were fully loaded. By installing G-E capacitors at or near each large motor, they took the magnetizing or kilovar load off the feeders, and were able to install three new motors for every ten they had. All this without adding a pound more copper or any additional transformers.

If you have a power factor or demand clause in your power contract, capacitors may make big savings in your power costs, too. Yearly returns of 30, 40, and even 50% on the investment are not unusual.

We strongly urge you to make sure that *your* plant is taking *full* advantage of capacitors. A G-E specialist will gladly co-operate with your engineering staff. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

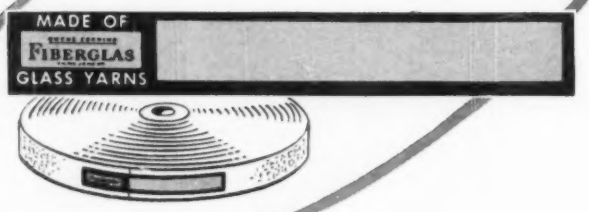
A NEW BOOKLET explains how capacitors work and gives specific data to show you what you may expect from them. Write today for Bulletin GEA-5167. Apparatus Department, General Electric, Schenectady 5, New York.

For other power distribution ideas that will save you money, ask your electric utility to show you the full-color slide-film, "Modern Industrial Power Distribution," or contact your G-E representative.

GENERAL ELECTRIC

GEA-5284

LOOK FOR THE FIBERGLAS* LABEL



. . . it means that Fiberglas glass yarns have been used in the tape, sleeving, cloth, or cordage you are receiving.

That's good . . . *because Fiberglas yarns don't rot, don't burn, don't absorb moisture. They do resist corrosion. They are also strong, light, compact; help save space in design.*

Specify electrical insulating materials made with Fiberglas yarns.

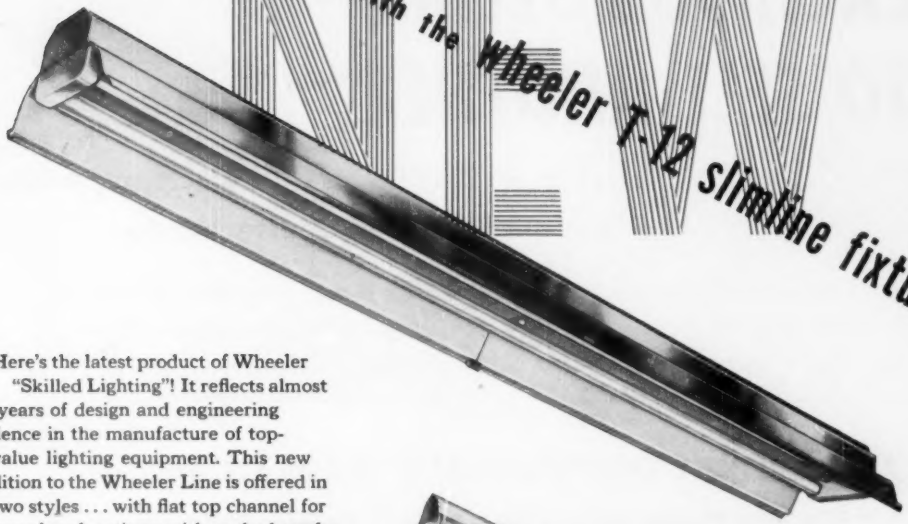
Owens-Corning Fiberglas Corporation, Textile Products Division, Dept. 856, 16 East 56th Street, N. Y. 22.

OWENS-CORNING FIBERGLAS *Yarns*

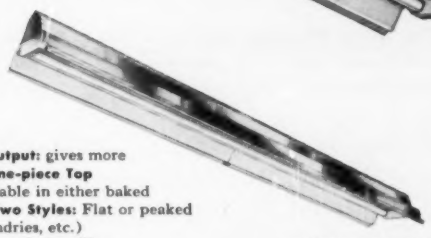
*Fiberglas is the trade-mark (Reg. U. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with glass fibers.

modernize your plant lighting with the Wheeler T-12 slimline fixture

NEW



Here's the latest product of Wheeler "Skilled Lighting"! It reflects almost 70 years of design and engineering experience in the manufacture of top-value lighting equipment. This new addition to the Wheeler Line is offered in two styles . . . with flat top channel for ordinary plant locations; with peaked top for locations where excessive moisture and dust-laden air conditions exist.



PEAKED TOP MODEL

6 Better-Value Features **1. High Output:** gives more light per foot of lamp length. **2. One-piece Top Channels:** made of heavy gage steel. Available in either baked enamel or vitreous porcelain enamel finish. **3. Two Styles:** Flat or peaked top channels (the latter for textile mills, foundries, etc.) **4. Reflectors in Sections:** for greater ease in handling, each unit furnished with two open-end-type porcelain enamel reflectors. **5. Individual or Continuous Mounting. 6. Latest G.E. Twin-Turret Type Lampholders** (depressable): for single pin contact, making lamp insertion and removal simple.

The new T-12 Slimline Unit is designed for use with two 75 watt, 96" T-12 Slimline single pin lamps (instant starting) operating at 425 MA. Send for complete details of this new "Skilled Lighting" fixture built to stay new-looking for years. *Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.* Also New York, N. Y. Representatives in principal cities.

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

Wheeler REFLECTORS

SKILLED LIGHTING

MADE BY SPECIALISTS IN LIGHTING EQUIPMENT SINCE 1881

"I've installed 10 jobs of Uskon Heating so far and

EACH JOB SEEMS TO SELL ANOTHER!"

says E. R. DAYTON, *Electrical Contractor*, Cape Cod, Massachusetts

After only 8 months of handling Uskon, Mr. Dayton finds this revolutionary electrical radiant heat has really put him into the heating business, pushed volume and profits way up. Every Uskon installation means 4 to 5 times more dollar volume and profit than an ordinary house wiring job.

APPROVED BY UNDERWRITERS' LABORATORIES, INC.

- **Uskon consists of rigid panels, ¼ inch thick, which become the ceiling, providing even, healthier, cleaner, trouble-free heat.**
- **Sold and installed by electrical contractors.**
- **Uskon now entering 4th successful winter in homes from coast to coast.**

SUBSTANTIAL MARGINS OFFERED TO THE CONTRACTOR. For selling and properly installing Uskon, the electrical contractor receives a substantial margin. In commercial and industrial applications the profit opportunities are proportionately greater.

Take advantage of this opportunity to get into the heating business. Write Uskon, Graybar Electric Company, 420 Lexington Avenue, New York 17, N. Y., or direct to Electrical Wire and Cable Department, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

USKON®

The Sunshine Heat

ELECTRIC RADIANT CEILING PANELS

Made by UNITED STATES RUBBER COMPANY

Distributed by GRAYBAR ELECTRIC COMPANY

built like a bridge

"The Monroe"

96" T-12 SLIMLINE and
STANDARD 40-WATT
LUMINAIRES

Framed-plastic, aluminum or steel side-panels; designed for quick and easy surface or pendant mounting, individually or in continuous row.

"Pittsburgh" Permaflector

"LIGHT BEAMS" for BUILDING FOOT-CANDLE LEVELS

This actual photograph of a pendant mounted "Monroe" Slimline Luminaire proves our point that it's "built like a bridge." The "Monroe" is not recommended for heavy foot-traffic, but its bridge-like construction provides for perfect alignment on continuous runs with hangers spaced only at every 8 feet. This minimum of hangers and the unit's rugged construction mean reduced installation costs and improved appearance.

In design, in construction, in flexibility of use—the new "Monroe" is the ideal fluorescent unit. Its efficiencies of up to 83% with 25/35° shielding; its low initial cost; its long service life add up to *good lighting at economical cost.*

WRITE TODAY for complete information on the "Monroe" and other Fluorescent Luminaires in the Pittsburgh Permaflector Presidential Series.

PITTSBURGH REFLECTOR COMPANY

404 OLIVER BUILDING • PITTSBURGH 22, PENNSYLVANIA

Permaflector Lighting Engineers in All Principal Cities

PITTSBURGH PERMAFLECTORS ARE DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

Your Central Conduit Distributor

...READY AT YOUR BECK AND CALL

Your Central Conduit Distributor is *always* ready at your beck and call...even if it means personal inconvenience. He's built his business on prompt service. And he maintains balanced stocks of quality electrical supplies ...like Central Rigid Steel Conduit...famous for easy cutting, bending and threading.

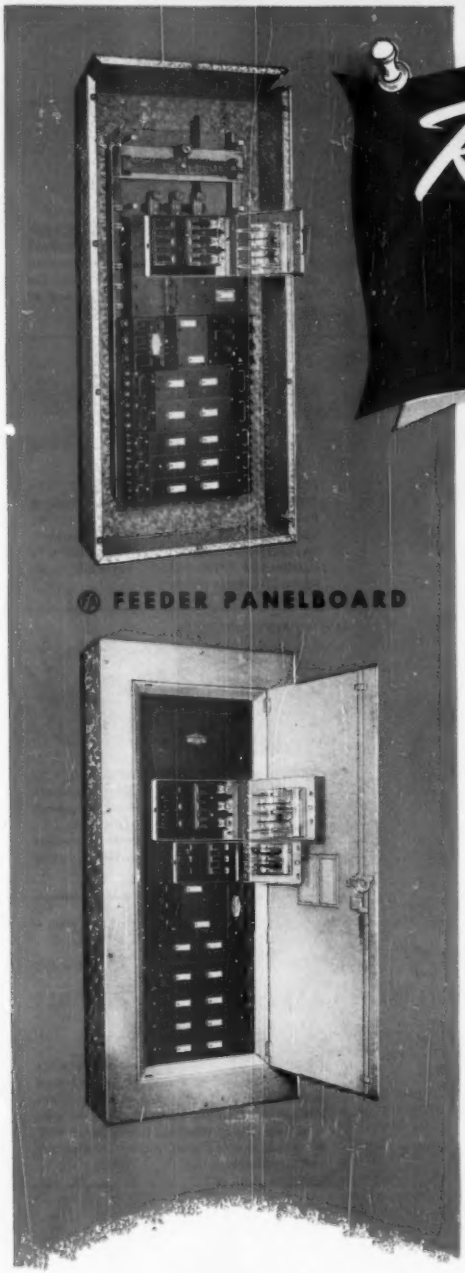
Next time you need conduit or other electrical supplies, contact your Central Conduit Distributor. You'll like his friendly service.

SPANG-CHALFANT
Division of The National Supply Company
General Sales Office: Grant Building, Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.



FA FEEDER PANELBOARD

Re-designed inside and out

LESS SPACE IS REQUIRED for the same panelboard requirements in the *re-designed* FA FEEDER PANELBOARD . . . without sacrificing such popular FA features as generous wiring space and ease of installation.

This improved, compact FA FEEDER PANELBOARD is built of standardized units and assembled as required for specific application. Four standardized widths, 10 standardized heights and 3 standardized depths of boxes meet any requirement. Boxes are shipped from stock . . . with removable ends to permit drilling conduit openings on the job. Panels are readily installed after boxes are in position.

Two dependable FA Switches . . . the FA PULFUZ-SWITCH and the FA KLAMPSWITCHFUZ . . . make these feeder distribution panelboards the finest in safety and efficiency. Both types combine switch and fuse in one unit so that current is OFF when the door is opened, or the fuse carrier removed. This makes replacement of fuses safe . . . quick . . . simple.

In operation, the switch blades make pressure contact with the fixed switch parts, assuring full current-carrying capacity. Silver-plated contact parts insure low resistance to current flow, and reduce heating.

FA PULFUZSWITCH capacities: 30, 60 and 100 amps., 250 volts AC or DC; 30 and 60 amps., 600 volts AC, 2, 3 and 4 pole.

FA KLAMPSWITCHFUZ capacities: 30 to 600 amps., 250 volts AC or DC; and 30 to 200 amps., 600 volts AC in 2, 3 and 4 pole types, single or double throw.

For more information about the *re-designed* FA FEEDER PANELBOARD, talk it over with your FA Representative (he's listed in Sweet's).

Frank Adam Electric Co.

ST. LOUIS 13, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

(Model 901) PORTABLE TEST INSTRUMENTS available in DC, Model 901—and AC, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

SENSITIVE RELAYS a line of sensitive relays including the Model 705 which provides positive control at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

(Model 622) ULTRA-SENSITIVE INSTRUMENTS portable DC and AC Thermo instruments for precision measurement of potentials and minute currents involving electronics, thermo-couples or laboratory research.

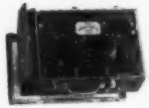
INSTRUMENTS

TO SPEED AND SIMPLIFY ELECTRONIC PRODUCTION AND MAINTENANCE

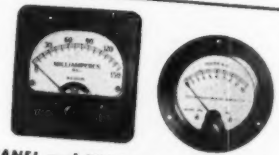
Illustrated are but a few of the many specialized instruments available from WESTON . . . all designed to simplify and speed-up electrical and electronic installations, production testing, and maintenance. For details, see your local representative, or write Weston Electrical Instrument Corporation, 672 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON *Instruments*

ALBANY • ATLANTA • BOSTON • BUFFALO • CHARLOTTE • CHICAGO
CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HOUSTON
JACKSONVILLE • KNOXVILLE • LITTLE ROCK • LOS ANGELES
MERIDEN • MINNEAPOLIS • NEWARK • NEW ORLEANS • NEW YORK
ORLANDO • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER
SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE • TULSA
IN CANADA, NORTHERN ELECTRIC CO., LTD., POWERLITE DEVICES, LTD.



(Model 798) MULTI-PURPOSE TUBE-CHECKER offering provision for testing Receiving Tubes — Voltage Regulator Tubes—Light Duty Thyratron Tubes such as 2A4—6D4—884—885—2051. Scale is calibrated "Good-Bad" as well as in mutual conductance range.



PANEL and SWITCHBOARD INSTRUMENTS a complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including DC, AC power frequencies and radio frequency, rectifier types and D.B. meters.

(Model 697) VOLT-OHM MILLIAMMETER one of a line of pocket-size meters, Model 697 combines a selection of AC and DC voltage, DC current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.

(Model 785) INDUSTRIAL CIRCUIT TESTER a versatile, portable tester for laboratory or maintenance needs, where an ultra-sensitive instrument is required. Provides 27 AC and DC voltage, AC and DC current, and resistance ranges. (DC sensitivity 20,000 ohms per volt.)

(Model 779, Type 1) SUPER-SENSITIVE ANALYZER small, light, compact, 26 range Volt-Ohm-Milliammeter with 5 DC voltage ranges, sensitivity of 1000 or 20,000 ohms per volt. AC temperature compensated. Self-contained power supply. Ideal for many production and test requirements.

(Model 769) ELECTRONIC ANALYZER incorporating a conventional Volt-Ohm-Milliammeter with self-contained power source—a high-impedance electronic Volt-Ohmmeter using 115 volt, 60 cycle power—a stable, probe-type, Vacuum Tube Voltmeter, for use to 300 megacycles.

how GOOD can PLANNED LIGHTING be without good equipment?

THE answer is—no better than a building plan without good building material. There is no dodging the fact that Good Equipment is the BASIC factor in a GOOD LIGHTING PLAN. It is the lighting units, the lampholders, the ballasts, the reflector, etc., which MAKE or BREAK the final results, in terms of sustained lighting efficiency, low-cost maintenance and dependable operation.

That's why, no matter how good the Lighting Plan, the results may be disappointing unless the plan includes GOOD EQUIPMENT.

the PUBLIC must be BETTER INFORMED on the importance of GOOD lighting equipment

As an industry, and as individual business men, we fail in selling PLANNED LIGHTING when we do not sell the importance of GOOD EQUIPMENT at the same time. It is our obligation that we keep faith with our customers by giving them the UNVARNISHED FACTS about the DIFFERENCE between GOOD and INFERIOR or SUBSTANDARD EQUIPMENT in terms of the factors listed below.

The buyer is entitled to KNOW these facts and to be TOLD and SHOWN that there are POSITIVE PROTECTIONS provided by the lighting industry, which assure him that the equipment he buys is in the GOOD EQUIPMENT BRACKET . . . the QUALITY BRACKET. *Proof of Quality* in lighting equipment is MADE EASY through such proof elements as:

CERTIFIED BALLAST LABEL

RLM LABEL

UNDERWRITERS' LABORATORIES LABEL

ELECTRICAL TESTING LABORATORY TESTS

These provide the buyer not only with the assurance that MINIMUM STANDARDS for performance have been met, but also that UNIFORM QUALITY is continuously maintained from one piece of equipment to the other.

FREE Booklet . . . The RLM Standards Institute has published a booklet containing the detail of each specification for each type of lighting unit for which RLM Standards have been established, as well as a complete summary of the IMPORTANCE OF THE LABEL in terms of CUSTOMER BENEFITS.

How the RLM Label provides assurance that the equipment is of uniformly high quality is shown through an outline of the RLM CONFORMANCE PROGRAM. Under this program, the Electrical Testing Laboratories make periodic tests of samples obtained from factory or market place to make sure that all equipment bearing the RLM Label consistently and continuously adheres to RLM Standards.

Make the RLM BOOKLET a part of every Planned LIGHTING PROPOSAL! . . . Write to the RLM Standards Institute for your COMPLIMENTARY COPY (or copies) of the RLM SPECIFICATION BOOKLET *today*. Plan to attach a copy to every PLANNED LIGHTING proposal you submit . . . let it help you point out to your customers that GOOD EQUIPMENT is BASIC to GOOD PLANNED LIGHTING.

the PUBLIC is entitled to KNOW these FACTS about GOOD LIGHTING EQUIPMENT

CONSTRUCTION: Good Lighting Equipment features structurally sound fabrication and heavy steels for maximum resistance to sag, distortion and breakage.

FINISH: Good Lighting Equipment features reflector finishes that insure your getting all the light you pay for . . . this year and ten years from now! That is why good equipment so overwhelmingly features PORCELAIN ENAMEL—the one and only commercially available finish that cannot deteriorate or corrode, regardless of the industrial atmosphere. Additional advantages of Porcelain Enamel are (1) that it is the only finish whose original efficiency can be sustained year after year by simply washing it with soap and water, and (2) that it is UNSURPASSED as a reflecting surface, because it ideally combines a high reflection factor with a high diffusion factor, insuring high light output with a minimum of glare.

REFLECTOR DESIGN: Good Lighting Equipment insures good lighting through reflector design that conforms to the most accepted principles of Illuminating Engineering. Such design protects the workers' eyes while delivering, not only the *most light* per dollar, but also the *required quality of light* for the individual Seeing Task.

SOCKETS, STARTERS, LAMPHOLDERS: Good Lighting Equipment features ruggedly constructed parts that withstand years of use and embody special design which facilitates quick, money-saving maintenance and low-cost operation.

BALLASTS: Good Lighting Equipment insures you against trouble by employing only the highest quality certified ballasts. Ballasts last longer because sound electrical and mechanical design prevents high temperature ballast operations. Lamps last longer because certified ballasts supply proper starting current and maintain proper operating watts to the lamp. Present wiring capacity is used most efficiently by the high power factor of quality ballasts.

This Advertisement is published in the Interest of the Entire Lighting Industry by

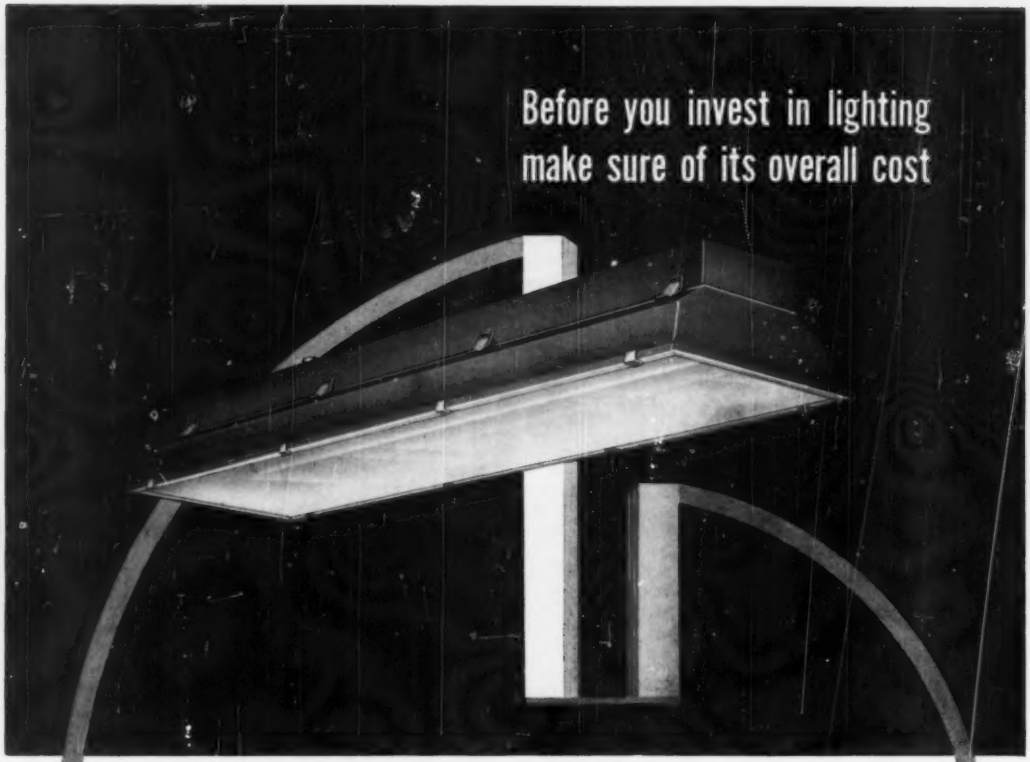
RLM STANDARDS INSTITUTE
INCORPORATED

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

R-2487

RLM STANDARDS INSTITUTE, SUITE 819, 326 W. MADISON ST., CHICAGO 6, ILL.

Before you invest in lighting make sure of its overall cost



New Miller "DUST TIGHT and VAPOR TIGHT" luminaires have broad application in industrial areas where inflammable dusts are present in the atmosphere and in non-hazardous locations where luminaire components must be protected from non-combustible vapor and dusts.

OVERALL cost is equipment cost, *plus* cost of installation and maintenance. Built into all Miller lighting equipment are construction features that simplify installation and maintenance, and make for LOW OVERALL COST. When you add to this, fine illumination performance and pleasing appearance, you have the reason why Miller lighting equipment is your best investment in lighting. It is built on our 8-Point Standard of Quality Construction, and strict adherence to our 106-year tradition of pioneering in GOOD LIGHTING AT LOW OVERALL COST. Whatever your lighting requirements, you can light with confidence the proven Miller way. Miller field engineers and distributors are conveniently located. Write for "DUST TIGHT and VAPOR TIGHT" Catalog.

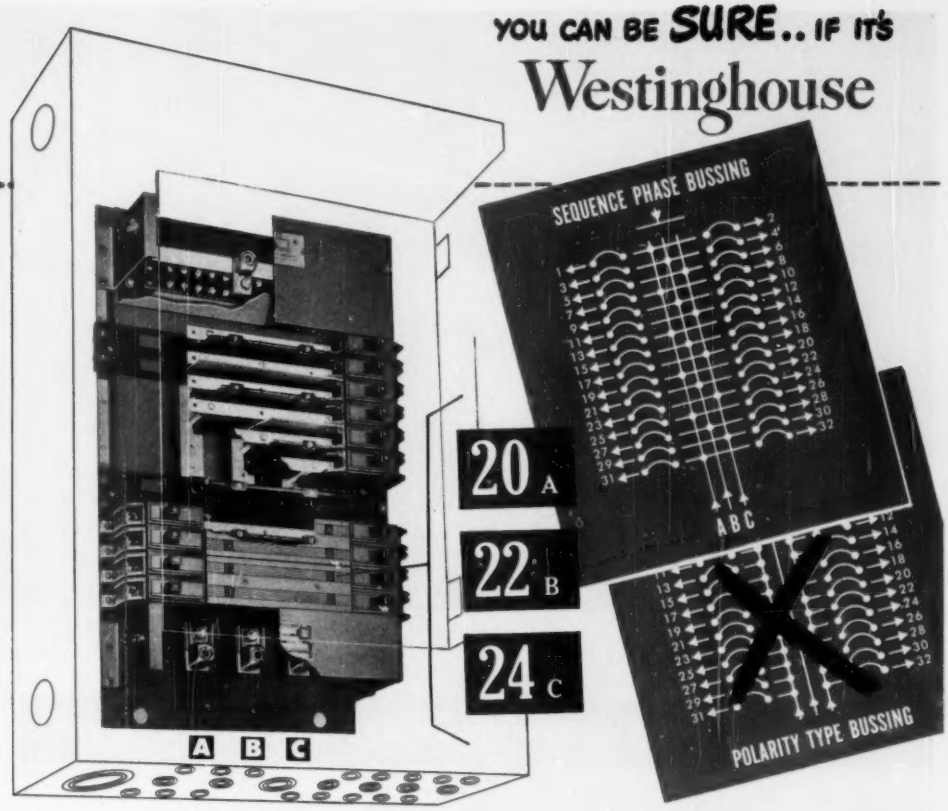
"Painting Toward Architecture" — a book about The Miller Company's collection of abstract paintings related to Architecture. Available at leading book stores.

THE miller COMPANY
SINCE 1844
ILLUMINATING DIVISION, MERIDEN, CONNECTICUT

ILLUMINATING DIVISION: Fluorescent, Incandescent, Mercury Lighting Equipment. HEATING PRODUCTS DIVISION: Domestic Oil Burners and Liquid Fuel Devices. ROLLING MILL DIVISION: Phosphor Bronze and Brass in Sheets, Strips and Rolls

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



HOOKS UP *"easy as A-B-C!"*

Here is a new feature of all Westinghouse 3-phase, 4-wire Lighting Panelboards which cuts installation time and makes inspection easier. Each circuit, and the main bus to which it is attached, is clearly identified by the letters A, B or C.

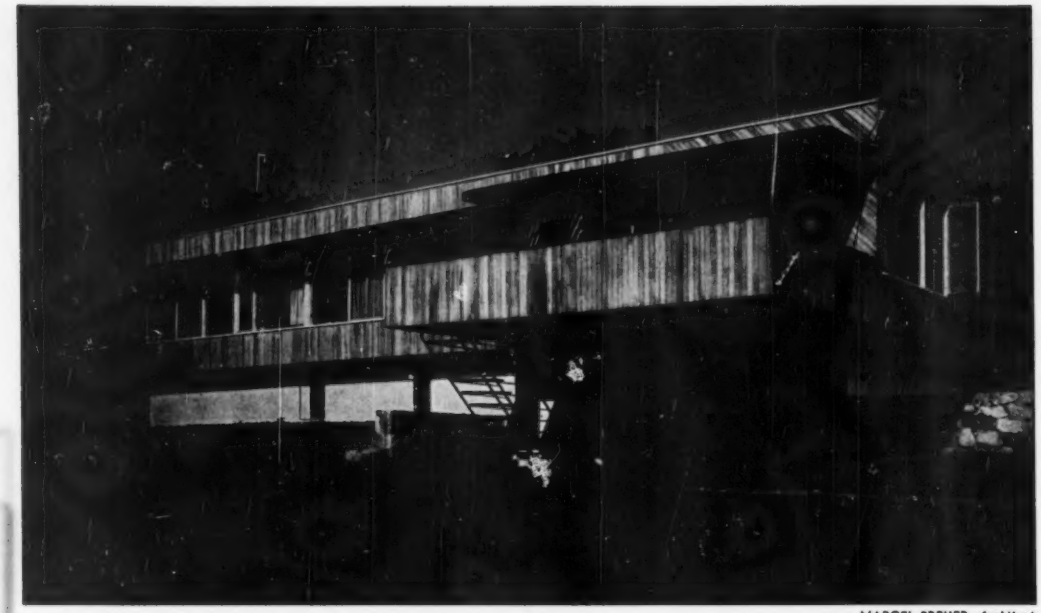
This easy identification is made possible by the sequence phasing method of bussing which is now standard on all of these Westinghouse Lighting Panelboards. Gone is the old polarity-type bussing —the time-consuming "ringing-out" of circuits is eliminated. What's more, this feature that speeds up the hookup is but one of many *extra* details of construction that is standard on all Westinghouse Lighting Panelboards.

To provide local panelboard service in your area, 13 Westinghouse Panelboard Assembly Shops are pin-pointed throughout the country. To get the complete story on Westinghouse Engineered Panelboards, and their moneysaving "extras", contact the Westinghouse Office nearest your phone. Or write for Descriptive Bulletin 30-930 to Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

J-40378

Westinghouse

PANELBOARDS



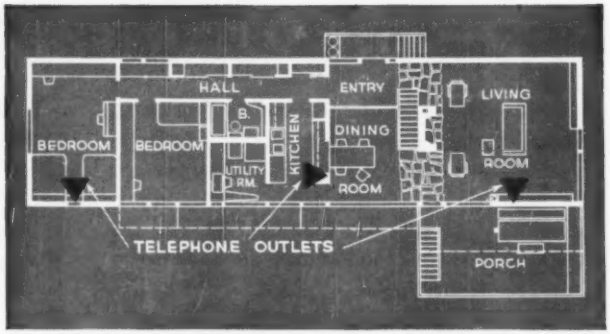
MARCEL BREUER, *Architect*

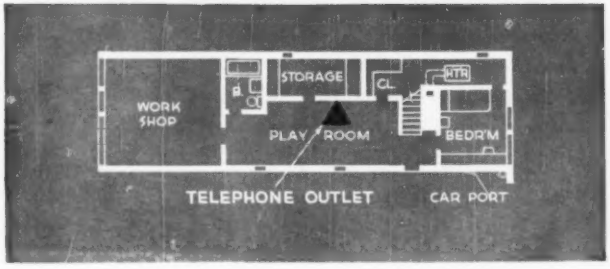
HOMES WITH A FUTURE HAVE TELEPHONE RACEWAYS

Modern home planning considers the future as well as the present needs of the owner. Telephone raceways conceal telephone wires *within* walls. They also provide for the relocation or addition of telephones later on.

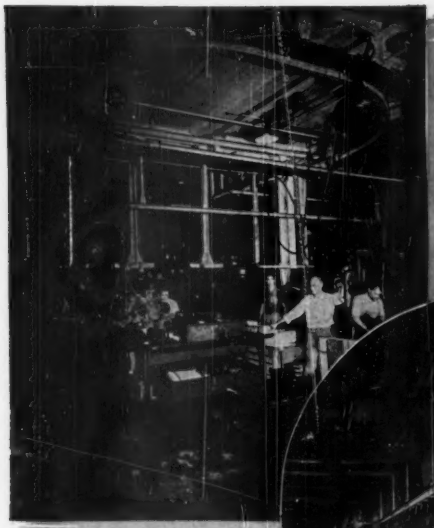
It's easy and inexpensive to provide for telephone facilities during construction. And it means extra profits for you. A few lengths of pipe or tubing placed in the walls will carry telephone wires to outlets located at key points throughout the house.

Remember—NO ELECTRICAL CONTRACT IS REALLY COMPLETE UNLESS IT INCLUDES RACEWAYS FOR TELEPHONE WIRES.





BELL TELEPHONE SYSTEM



Overhead

On Test

On the Production Line

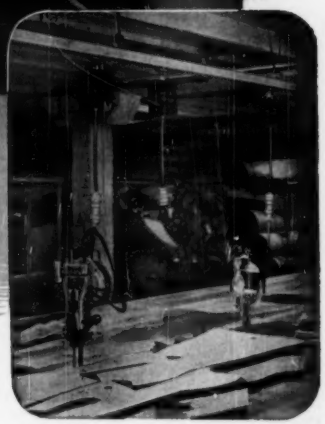
IF IT MOVES *it should be* FEEDRAIL

Ask any electrical maintenance man. He will say half his time is consumed in the repair of loose or exposed wires, and broken or faulty connections. Ask any safety man. He knows moving electrical equipment is one of the worst hazards in the plant.

Then install Electric Feedrail, the modern, totally enclosed electric distribution system. Watch men work with portable tools connected to the overhead trolley with Ever-Lok trouble-proof connectors. See what it does for moving test lines, lights, cranes and hoists. Everywhere it speeds production, saves maintenance, and reduces electrical hazards.

You can see what it is doing for others by asking for the New Feedrail Catalog No. 20, 32 pages, more than 100 illustrations, diagrams and specification data. Write for your copy to-day.

On the Bench



24

ELECTRIC FEEDRAIL

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

Thread 2" pipe in 22 seconds with TOLEDO POWER PIPE MACHINES!

● *You can save up to 80% on pipe threading time*—by using a portable TOLEDO No. 999 Power Pipe Machine instead of hand methods! This saves labor... reduces costs!

The Super Model threads 2" pipe in 22 seconds... or 30 seconds with Standard Model. Cuts off 2" pipe in 10 seconds. Combines speed, production, strength, compactness, portability, dependability and low cost! Ask your distributor for complete details and price. Write for new catalog. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office: 165 Broadway, Room 1310.

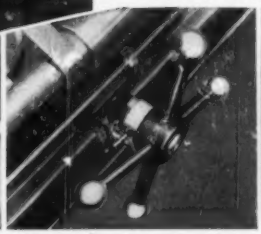
RELY ON THE LEADER

TOLEDO

FOR PRECISION PIPE TOOLS

CONTROLS... entirely within forward and reversing switch. Speed adjusted automatically.

REAMING... with 12 tooth cone type fluted reamer mounted on arm on cutter head.

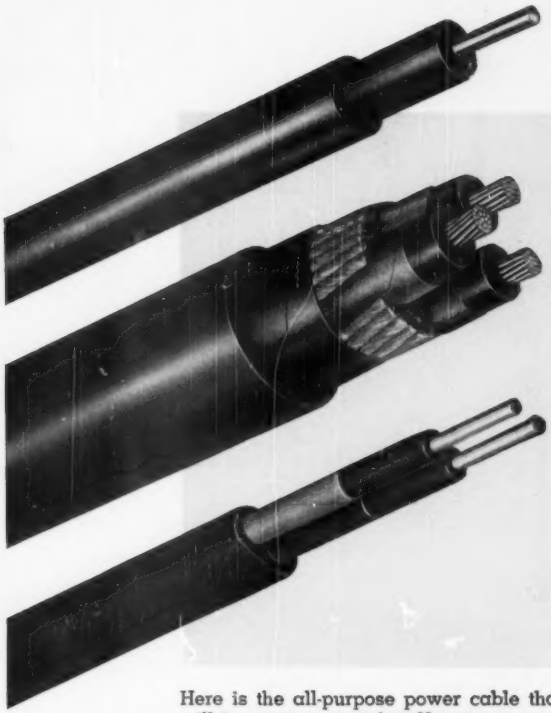


THREADING... speedy, accurate. Thread gauge shows length of thread being cut.

CUTTING... especially fast with 4 cutting knives. Perfect square end cuts. No burred edges.

Sell the all-purpose power cable

RoMarine - RoPrene



RECOMMENDED FOR

DIRECT BURIAL

OVERHEAD

IN CONDUIT

Here is the all-purpose power cable that will increase your sales. You can recommend and sell RoMarine-RoPrene for any power distribution job, whether for direct earth burial, installation in air, in conduit, or for circuits combining all three.

Check these advantages, then sell and install RoMarine-RoPrene

- RoMarine insulation is a quality compound possessing long-aging, as well as moisture and heat resisting properties
- RoPrene sheath is specially compounded Neoprene with high resistance to soil acids, alkalies, moisture, corrosive fumes, sun checking, flame and abrasion.
- Less costly than metallic sheathed cables . . . easier to handle and splice . . . eliminates problems of electrolysis.
- *First* to be approved by Civil Aeronautics Administration under Specification L-824 for airport wiring.
- Underwriters' approved as Type USE—Style RR.
- Available in single, two, and three conductors.

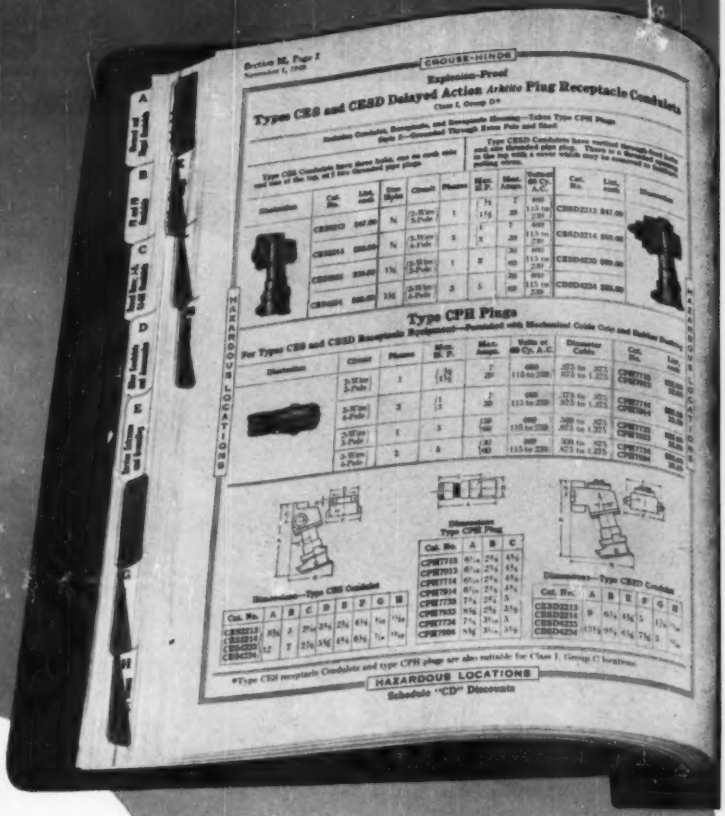
RoMarine-RoPrene cable has an excellent performance record. It is nationally advertised. Cash in on all of these advantages . . . sell it today!

ROME CABLE Corporation
ROME, NEW YORK
From Bar to Finished Wire

ROME CABLE ROME, N.Y.

It Costs Less to Buy the Best
. . . Sell RoMarine-RoPrene

CROUSE-HINDS *Announces a*



. . . with many

The many improved features in this catalog are the result of our years of cataloging experience combined with helpful suggestions from users of our products.

Among the outstanding features of the catalog are the logical divisions of Condulets into sections, the arrangement of the Condulets within the sections and the colored index tabs which simplify its use. For example, Section S contains listings of Condulets for industrial control. Section K contains listings of lighting fixtures

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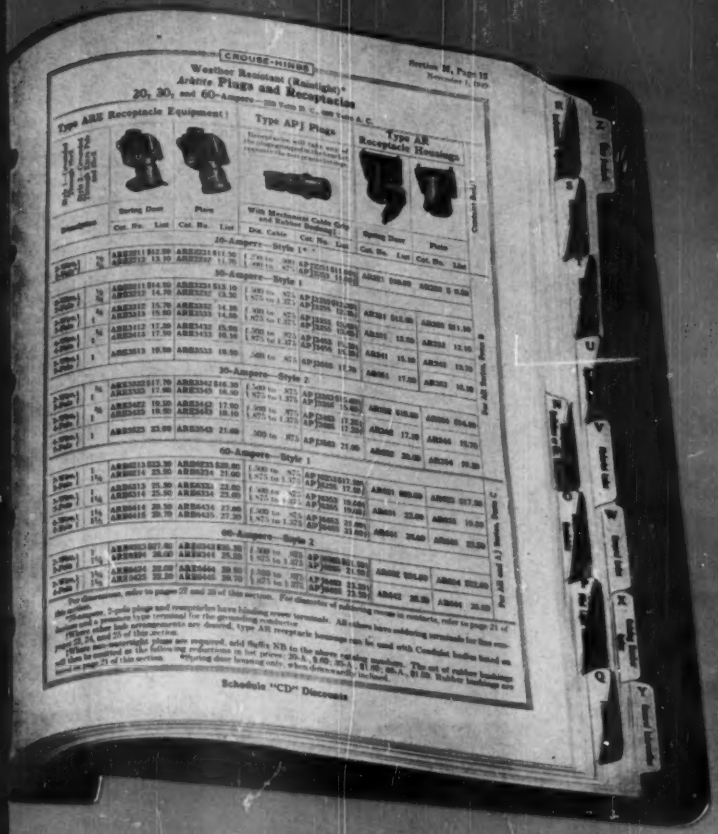
CONDULETS • TRAFFIC SIGNALS

NEW CONDULET Catalog

No. 3000



CONDULET
REG. U.S. PAT. OFF.
First in the field
STANDARD OF QUALITY

NEW features for your convenience

for general illumination. Section T contains listings of circuit breaker Condulets.

BUFF index tabs identify Condulets for use in non-hazardous locations.

RED index tabs identify Condulets for use in hazardous locations.

Combined RED and BUFF tabs identify Condulets for use in both hazardous and non-hazardous locations.

These features make this catalog a convenient reference book from which to select proper Condulets for required applications.

CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. Pacific Division Representatives: Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va. — Salt Lake City
CROUSE-HINDS COMPANY OF CANADA, LTD., TORONTO, ONT.

AIRPORT LIGHTING • FLOODLIGHTS

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*

Rigid steel walls for permanent protection

RIGID steel conduit is the only wiring system approved by the National Electrical Code as moisture-, vapor-, dust-, and explosion-proof in hazardous locations.

Specify and use "Buckeye," the world's largest selling, standard-threaded, full-weight, rigid-steel conduit, and you insure permanent protection for wiring in any location.

Youngstown Buckeye Conduit is distributed through supply dealers in every industrial market.

Youngstown

BUCKEYE CONDUIT

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steel

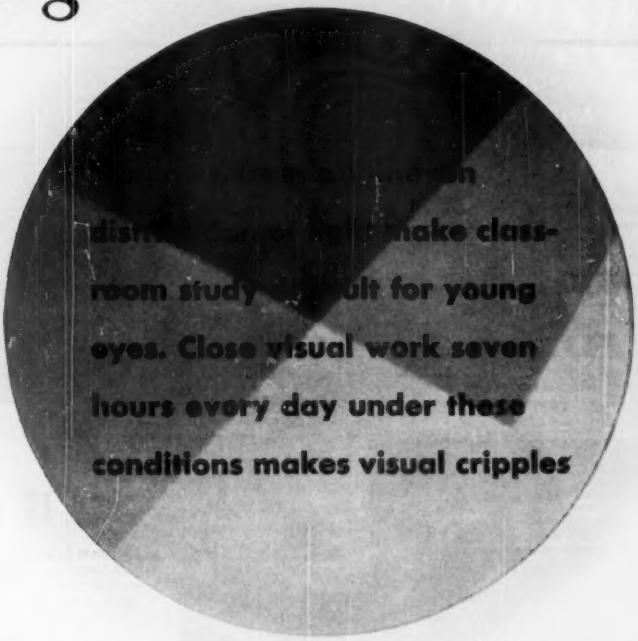
General Offices — Youngstown 1, Ohio

Export Office - 500 Fifth Avenue, New York

CONDUIT - PIPE AND TUBULAR PRODUCTS - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - TIE PLATES AND SPIKES.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Why is this hard to read?

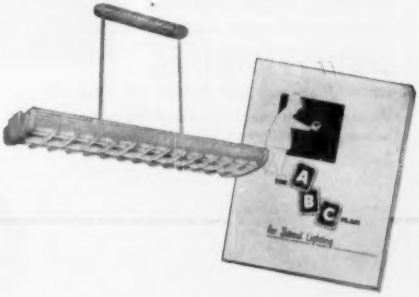
The circle tells its own story of a common classroom problem. But shadows are only one of many classroom lighting problems.

Since each classroom lighting situation is different, there is no "cure-all" lighting fixture on the market today. Determine which factors bear the highest priority in your customer's situation, then plan a complete lighting system for best results.

This story—a customer's approach to classroom lighting problems—is in the ABC Plan for School Lighting, B-4556.

Whether you plan lighting—buy lighting—or install lighting, this book should be on your desk. Ask any Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

Name any lighting problem—we have the fixtures and know how to apply them—and ONE will be the BEST BUY for you and your customer. J-04251-A



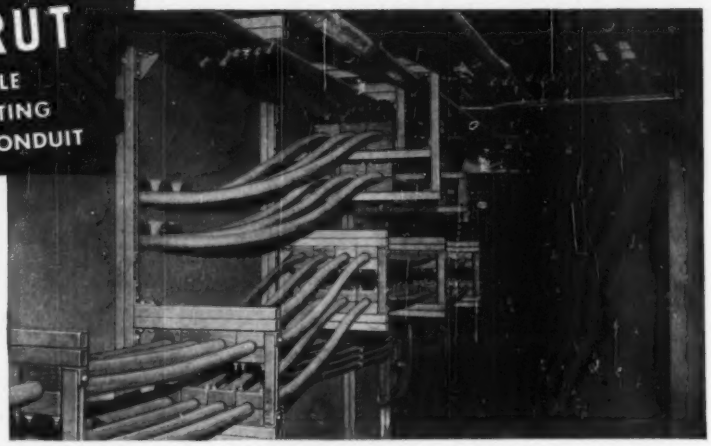
Westinghouse

PLANNED
LIGHTING
PAYS

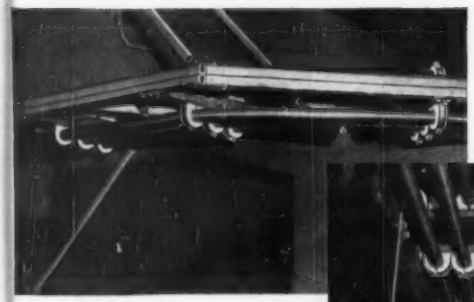
IOWA ELECTRIC LIGHT and POWER COMPANY

FINDS UNISTRUT THE MOST FLEXIBLE MEANS OF SUPPORTING HEAVY CABLE AND CONDUIT

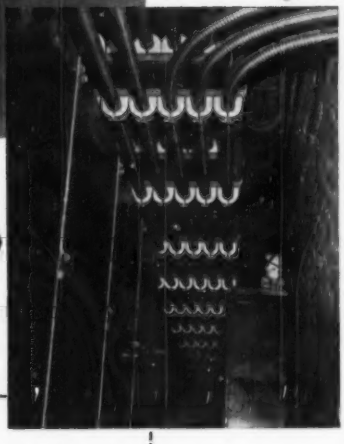
Like a giant Erector set, completely adjustable Unistrut simplifies the most difficult problems of supporting heavy cable and conduit used in distribution systems—permits fast, on-the-job framing assembly where all adjustments are easily made by just loosening a bolt, and supporting members added as work progresses. No drilling, no welding, no special tools or equipment—saves time, cuts costs. A trial of Unistrut on your next job will show you how much quicker, better and more economically the work can be done.



Notice Unistrut's trim steel framework. Note too the Unistrut porcelain and maple clamps that hold the heavy cable and conduit firmly in place.



An unusual bracing arrangement utilizes standard Unistrut channel and fittings in attaching the cable-supporting Unistrut framework to wall.



Rows of heavy armored cable are quickly installed and easily supported with completely adjustable Unistrut channel and porcelain cable clamps.

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THE 3 QUICK UNISTRUT STEPS

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2. Locate fitting and nut
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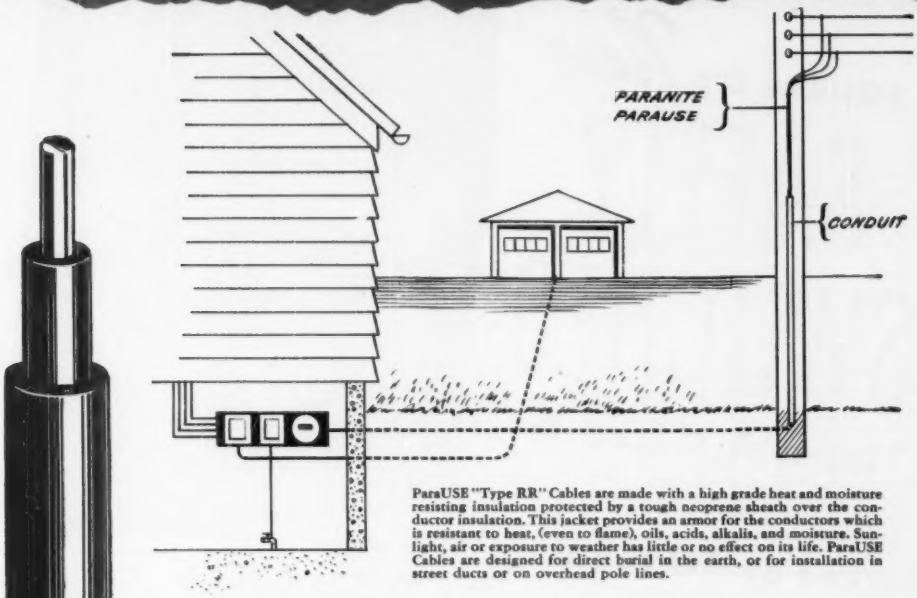

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MODERN STYLING is both functional and attractive.

COMPACTNESS obtained without sacrifice of wiring convenience.

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SIMPLE MECHANISM—quick make-and-break action—no dead center.

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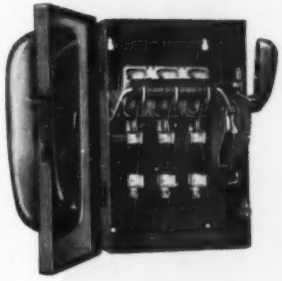

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JANUARY . . . *at a Glance*

Ballroom to Kitchen

Last month a great cooking contest was held in the ballroom of the Waldorf-Astoria. Ordinarily we would have observed it casually, if at all. But when we found Steve O'Brien's versatile organization alerted for the event, we paid heed and found an electrical job quite as glamorous as the contest. The contract called for 100 electric ranges, all on at once, a load you don't plug in to the nearest outlet. It took advance planning, careful engineering and stop watch installation schedules, but the contest carried on without so much as a blown fuse. How it was done is described in "100 Ranges Wired in 5 Hours" on page 54.

Looking Ahead

If current trends carry through we can expect another big volume year, over $2 billions in electrical work. A good part of that amount is directly linked to new private construction already planned and another large segment to projected public work. Even severe economic bumps are not likely to exert any substantial influence on the totals within the year. For electrical work, however, some of the categories like industrial, stores and residences are considered to be "sensitive", they are likely to respond strongly to sales effort and promotion if general business maintains a prosperous level. Electrical modernization, rewiring, relighting and major appliance or apparatus installation is also expected to provide increasing volume this year. By and large the outlook for the industry which opens our feature section, page 49, this month is optimistic and relatively stable. If profits can be sustained under prevailing competition, it ought to be a very good year indeed.

Estimating

In this issue, page 52, we are beginning a new series of articles on basic electrical estimating methods. Probably no other facet of the electrical contracting industry presents more critical problems today than accurate cost estimating. For intelligent bidding or for job control the contractor needs to know his costs within very narrow limits or profit mark-ups become merely fond hopes. Modern estimating methods and well founded labor and material cost data skillfully applied are capable of producing cost estimates that come very close to actual job costs. And this is true not only for big construction projects but for all kinds of work, large and small. This series is a major project and will take in a wide range of estimating techniques. Your comments and suggestions as to how it can be most useful for our particular estimating problems are cordially invited.

Permit Diagram

The need for better pre-permit application information in Pontiac led J. W. Emerson, Superintendent of the Electrical Department there, to devise a method and a type of permit application that should arouse wide interest. Permit diagrams, even when they are provided, are inclined to be sketchy. The Pontiac plan provides a systematic method of presenting needed data. Details of the plan and its operation are described by Mr. Emerson in "Electrical Inspection Control" on page 56.

Selling Light

The pay-off from a course for electrical contractors on planned lighting application in Washington is showing up in local stores and offices. For a quick review of the program and a pictorial round-up of some of the results see B. C. Cooper's story "Contractors Push Planned Lighting" on page 58. It is noteworthy that good commercial lighting is contagious in the community and one of those fields in which the whole industry group can cooperate most effectively.

Modernization

Rapid changes in methods and plant output can leave once adequate wiring systems far behind. Expanding output at Ferro Enamel required an increase in electrical system capacity of ten times to take care of load growth. How the system change was handled is described by Carl Reich and J. T. Stone this month in "Power Modernization" on page 57.

Vanderlinde Sees Steady Business

Edward J. Vanderlinde, President of the National Electrical Contractors Association, in his year end outlook for the electrical construction industry says:

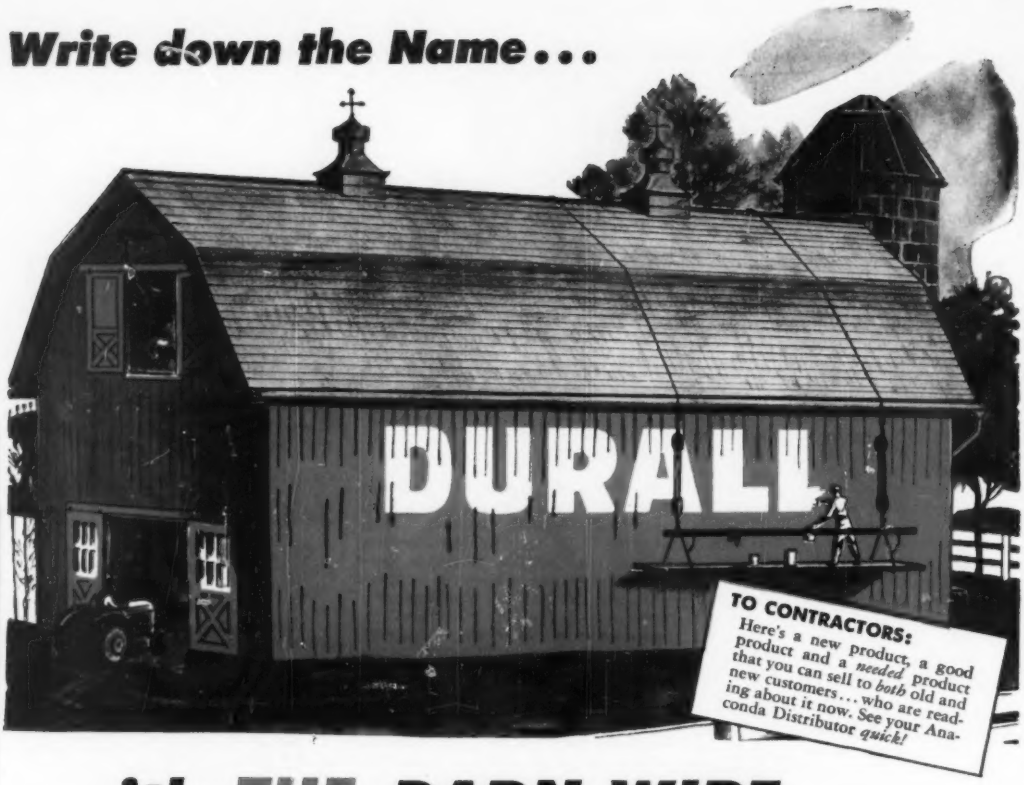
"There is every indication that 1950 will be a year of steady demand for the services of the qualified electrical contractor.

"The need for structures to house people, business and industry remains acute even after three years of record-breaking building volume. A $19 billion construction year is in prospect. But the opportunities for the electrical industry go beyond the needs of new construction. The accelerated obsolescence of the American industrial plant; housing, facilities, and equipment, presents a market of ever increasing magnitude. Effective electrical utilization is widely recognized as the key to greater production, and contract electrical maintenance is its standby.

"Electrical contractors can expect to do a $1,500,000,000 business in 1950. They will put in place more than $800,000,000 worth of electrical equipment, apparatus, material.

"And even these objectives may be surpassed in 1950. Today, more than anytime in his history, the electrical contractor is aware of the need of building his own business; of selling his services, and creating opportunities through sales effort. In these efforts, he will be backed this year by a comprehensive program of Electrical Modernization sponsored by NECA."

Write down the Name...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ANACONDA

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CAREFUL OPTIMISM

UNDER ALL THE OPTIMISM for the immediate outlook, there runs a curious counter-current of restraint. If leadership will arise, a host will follow—at a discreet distance. In the electrical industry this is a disturbing phenomenon.

STRONG CONFIDENCE in the future of electrical business during the next decade, however, is practically universal. A substantial market potential will be imposed upon us. There are minimum legal needs for new construction. There are the desperate efforts of ordinary people to enjoy the advantages of modern electrical equipment and appliances. There is a large share of building modernization and repair which cannot avoid electrical work. We can easily consolidate a practically sure thing.

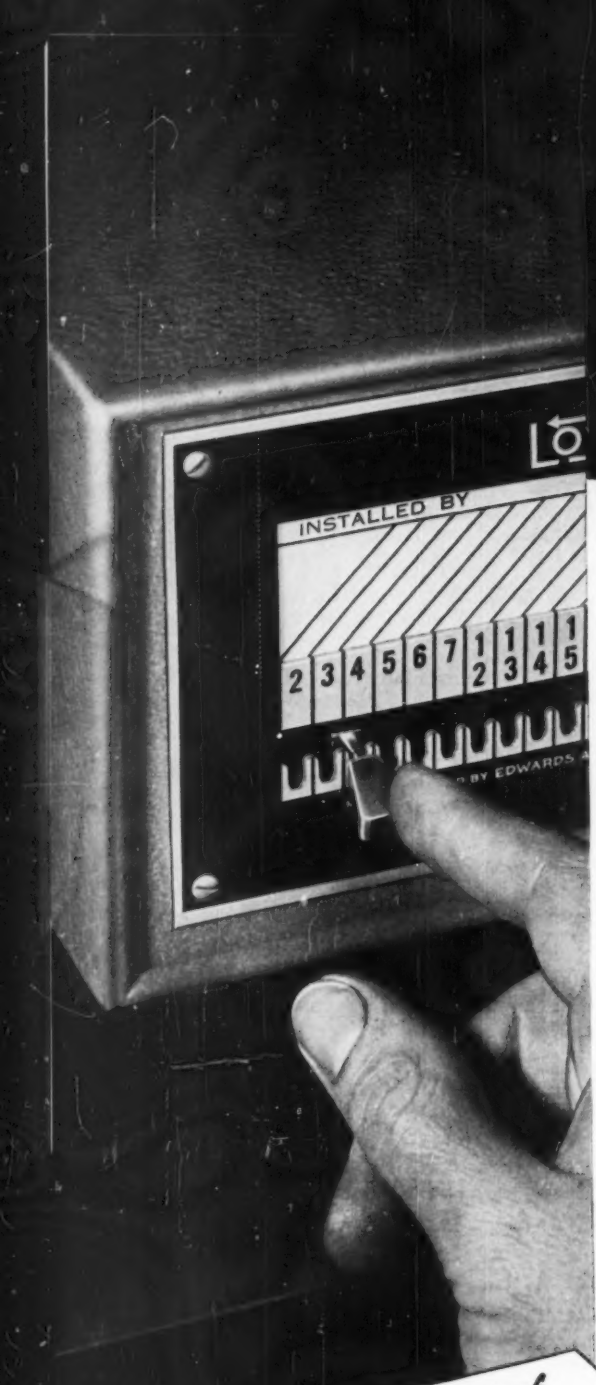
BUT THE ELECTRICAL INDUSTRY is creative. It has always been so. For every need and comfort it serves, it stirs up two new desires. It infiltrated, and eventually dominated entire industrial processes. It revolutionized the methods and techniques of the most solidly traditional and hard shelled industry of all, housekeeping. It multiplied accepted levels of illumination by ten times, all in little more than a single generation. Now all this and more wasn't done with conservative marketing, with cautious tread along the well marked paths, or with a private wire to Washington.

UNHAPPY SUBSERVIENCE to the goad of price competition, caution, riskless market exploration are completely out of character with the traditions and the potentials of the electrical industry. The sturdy foundation of practically guaranteed business opportunity ought to be an open invitation to build a greater superstructure.

ELECTRICAL MEN are traditionally leaders. For a decade they lived in harness with creative individualism directed to national tasks. It may take a little time, but the tradition will recover. We can expect to see men and industry groups seeking leadership, rather than waiting for someone else to show the sure and safe way.

THE FIFTIES are full of promise. The electrical construction industry can chart confidently large and fruitful markets. But no one of us can delegate the task of building those markets. The most optimistic projections, the best planned industry campaigns are only as good as the leadership and the initiative of the individuals who ultimately serve the public.

Wm. F. Stuart



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TRENDS

ELECTRICAL WORK will total over 2 billions in 1950, about even with 1949.

AVERAGE WEEKLY EARNINGS in electrical work was $85.43 in September '49, up $1.08 over the same period of the year before.

SOCIAL SECURITY tax rate raised to 1½ percent in 1950.

ALL CONSTRUCTION will require about 2,400,000 workers in the peak month of 1950.

AT TURN OF THE YEAR costs appear to be stabilizing on 4th quarter 1949 levels.

RECORD HOUSING starts of 1949 will be approached but probably not equalled this year.

REWIRING AND MODERNIZATION expected to rise 15-20 percent over last year.

ESSENTIALLY all materials for electrical work are in adequate supply for predicted volume.

OUTLOOK FOR '50

As good, or better, prospects lively this year in electrical construction; rewiring, relighting, installation due for upturn.

By W. T. Stuart

YOUR business volume in new electrical construction will be as good this year as last. Your margins may be better. Your opportunities for work not tied to new construction are bigger than ever. On the average, this is the picture that comes out of the new year forecasts. They are optimistic if we are satisfied with the way things are. To some malcontents, like the author, who see a larger evident destiny for the electrical construction industry, they offer a disturbing stability in a fast moving economy.

Construction predictions of the Department of Commerce indicate that new construction volume in 1950 will be the same as the 1949 record total, with less private but more public construction. The record of Commerce predictions during recent years shows that they have called the totals with fair accuracy. There are no side currents of enough significance at the moment to dispute their projections. And since electrical work is an essential fraction of all new construction, we have a solid, non-cancellable market for about 1½ billion dollars worth of our goods and services in 1950. Add changeovers, rewiring, modernization, lighting, installation, repairs, and the total industry market exceeds 2 billion dollars.

New Construction

The outlook is for another record year for construction in 1950, in terms of the dollar volume of new construction to be put in place. Indications are that the overall total of private and public expenditures for new construction will equal the probable 1949 total of $19½ billion, according to joint estimates of the Departments of Commerce and Labor. Private construction outlays in 1950 probably will drop about $925 million from the total for 1949, but public construction expenditures are expected to increase by a like amount.

Measured in terms of physical (as contrasted with dollar) volume, total new construction in 1950 is also expected to be on a par with that of 1949. Construction costs are expected to show a slight upward tendency in 1950 but the average for the year probably will be about the same as the average for 1949. During 1949, the Department of Commerce Composite Index of Construction Costs declined gradually from 211.3 (1939 = 100) in January to a low point of 205.1 in August. It turned upward slightly in September and October.

The total value of private construction to be put in place in 1950 probably will be about $13.1 billion, nearly 7 percent less than the anticipated total for 1949 of just over $14 billion. Declines are expected in all major classes of private construction—residential building, non-residential building, farm construction, and public utility construction.

A slackening of the recent unprecedented pace in new non-farm home building is foreseen for 1950. As a result of the boom in new dwelling units started since mid-year, a total of nearly 1,000,000 new units now appears to be within reach for 1949, shattering all previous records. The largest number of starts in any year prior to 1949 was the 1925 record of 937,000 units, a record almost equalled in 1948 when 931,300 new non-farm dwelling units were placed under construction. The 1950 total is expected to drop to about 900,000 units.

The outlook is for a decrease of about 7 percent in 1950 in the total

ESTIMATED ELECTRICAL CONSTRUCTION 1949–1950

(Electrical Construction & Maintenance Estimates)

Type of Construction	Millions of Dollars	
	1949	1950
Private—New Work		
Residential (non-farm)	560	520
Farm	36	32
Industrial	140	110
Warehouse, office and loft	30	30
Stores, restaurants, garages	84	87
Misc. non-residential	108	108
Railroads	23	21
Telephone and telegraph	52	45
Utilities	240	240
Total Private	1,273	1,193
Public—New Work		
Residential	15	28
Educational	84	90
Hospital and institutional	45	58
Other non-residential	35	40
Military and naval	6	5
Highway	49	57
Sewer and water	28	32
Misc. public service	5	5
Conservation and development	40	45
All other public	9	11
Total Public	316	371
Total New Construction	1,589	1,564
Modernization and Repair		
Service replacement	70	85
Appliance circuits	60	65
Rewiring	95	120
Relighting	160	190
Repairs and miscellaneous	50	50
Total Modernization and Repair	435	510
Total All	2,024	2,074

value of private non-residential building to be put in place. Industrial construction probably will drop about 26 percent from 1949. Construction of new churches and of social and recreational facilities also is expected to decline from the high levels of 1948 and 1949.

Building of new commercial structures, especially stores, has been lagging behind the rate that the need for additional commercial space would appear to justify. With it becoming apparent that substantial reductions in construction costs are not to be expected in the immediate future, some of the postponed construction of commercial facilities should get under way in 1950, particularly in the building of shopping centers for newly developed residential areas. The value of new commercial construction is expected, therefore, to show a small increase next year over the 1949 total.

Private educational building probably will continue at about the 1949 rate in response to the demand for additional facilities. A substantial increase in hospital and institutional building seems assured under the National Hospital Program.

Farm construction probably will continue to ease off, following the trend of farm income.

Railroads and telephone and telegraph companies are believed to have passed the peak of their immediate postwar construction programs and are expected to spend less for new construction in 1950. Electric light and power companies, likewise, probably will begin to curtail their new construction outlays. Gas companies, on the other hand, indicate intentions of increasing construction expenditures in 1950 above 1949 amounts.

Public Construction

The total value of all types of public construction to be put in place in 1950 is expected to exceed $6.1 billion, an increase of nearly 18 percent over the probable $5.2 billion total for 1949. Expenditures for all types of public construction probably will be larger, except for normal military and naval facilities.

Public housing probably will show the largest increase percentagewise, as a result of activities under the Housing Act of 1949. The value of new residential building put in place is expected to rise from about $220 million in 1949 to around $400 million in 1950, an increase of approximately 82 percent. The 1949 total of new public housing units started is expected to reach about 40,000, most of which are under State and local programs. Public Housing Authorities probably will start between 60,000 and 80,000 units.

Continued pressure for additional school facilities to take care of record enrollments should result in a further rise in public expenditures for educational buildings to about $900 million in 1950. The value of work put in place on veterans' hospitals and on publicly-sponsored hospitals under the National Hospital Program is expected to increase by about 27 percent to a total of around $575 million.

Highway construction will advance about 15 percent in dollar volume to reach $1.9 billion in 1950, judging from recent State and local actions to obtain additional highway funds through increases in gasoline taxes and through bond issues. Municipalities will expand construction of sewer and water facilities and of municipally-owned utilities to serve growing communities. A 20-percent increase in conservation and development work is also indicated by the Federal budget for river, harbor, flood control and reclamation projects.

Employment

Payrolls in prospect in electrical construction, installation and maintenance for the year are estimated at about 400,000,000 man-hours, or full time for 200,000 workers. Some improvement in average productivity and skill may be expected this year, particularly in those areas where well organized apprentice training is releasing new journeymen with superior schooling and planned job training.

No substantial change in unit labor costs is predicted for the year. While notable improvements are found on individual jobs through tooling, mechanization and superior job management, they evidence internal trends which do not show up in total market projections.

Material Costs

Costs of electrical materials are expected to remain in a fairly level range through 1950 with some prospects of an increase. After much rash discounting from net prices during the highly competitive months of 1949, sales policies are being tightened up in an effort to contain quotations within an area that offers some chance of profit.

Conduit and steel product prices are going to reflect the scarcity resulting from last year's strike and the higher manufacturing costs imposed by pensions. Manufacturers of wiring materials and equipment see little opportunity for cost reductions this year to offset rising tax needs and employee benefits.

Speculative gains or losses in electrical materials by timing the placing of job orders or buying for inventory are not likely to be a large factor this year overall. Price movement, fluctuation, even jitters, however, are a normal process in a competitive economy and they will be with us in full measure this year.

There is a good possibility that the seasonal aspects of construction will exert a larger influence on materials price and supply this year. Large inventories at the beginning of 1949, with the seasonal first quarter dip in construction activity helped to accelerate the inventory corrections of mid '49. Low inventories at the beginning of '50 combined with the quiet demand at the bottom of the annual construction cycle can leave stocks unprepared for the enormous increase in demand in the second quarter.

ESTIMATED NEW CONSTRUCTION ACTIVITY IN 1949 AND 1950

Joint Estimates of the Department of Commerce and the Department of Labor

(Millions of Dollars)

Type of Construction	1949	1950	Percent Change
Total new construction	19,250	19,250	0
Total private	14,025	13,100	− 7
Residential (excluding farm)	7,000	6,500	− 7
Nonresidential building	3,175	2,950	− 7
Industrial	975	725	−26
Warehouses, office and loft buildings	300	300	0
Stores, restaurants and garages	700	725	+ 4
Other nonresidential building	1,200	1,200	0
Farm construction	450	400	−11
Public utility	3,400	3,250	− 4
Railroad	385	350	− 9
Telephone and telegraph	575	500	−13
Other public utility	2,440	2,400	− 2
Local transit	40	40	0
Petroleum pipeline	160	160	0
Electric light and power	1,440	1,350	− 6
Gas	800	850	+ 6
Total public	5,225	6,150	+18
Residential	220	400	+82
Nonresidential building	1,645	1,875	+14
Educational	840	900	+ 7
Hospital and institutional	450	575	+28
Other nonresidential building	355	400	+13
Military and naval	120	100	−17
Highway	1,650	1,900	+15
Sewer and water	560	650	+16
Misc. public service enterprises	90	100	+11
Conservation and development	750	900	+20
All other public	190	225	+18

Electrical Work

The accompanying analysis presents the estimated dollar volume of electrical work on the same breakdown as the Department of Commerce new construction estimates. It will be noted that electrical work in new construction is predicted as slightly down from 1949. Modernization and repair is up. The totals are about even.

A large reduction this year in plans for industrial building affects electrical work at the "bricks and mortar" level. Another figure, however, should be introduced for better perspective. Capital expenditure for new plants and equipment shows a much smaller decrease, preliminary estimates give about 15 percent. And in industrial work electrical installations are affected more by equipment than by the cubic feet of space occupied.

No allowance has been introduced for possible utilization increases. This tends to show the figures on the conservative side. The influence of industry campaigns for electrical modernization, lighting, adequate wiring and other promotion was slow moving in 1949. They may well gain speed in 1950. In the long run they are bound to have a very significant effect on market projections.

A low ebb of electrical installation standards is still apparent from industry surveys and analysis of current plans and specifications. Electrical work has suffered out of proportion in project trimming to meet building budgets. A recent survey showed an average of six branch circuits in single family dwellings built last year, far below the needs of normal appliances now being marketed. Electrical adequacy and reasonable future capacity in office buildings and smaller projects is exceptional; however, a few of the larger projects are beginning to show evidence of design for modern utilization requirements.

The electrical modernization promotion program of the National Electrical Contractors Association, the N.E.M.A. programs and other industry efforts will be even more important this year if market objectives are to be reached.

Modernization and Repair

A new breakdown of electrical modernization markets has been introduced in our projection this year. The categories include new services, appliance and apparatus installation, rewiring, relighting and repair. These figures cover the field of electrical work which is not identified with other major construction activity. This is a market particularly sensitive to industry promotional activities and one which will become a larger factor in industry statistics in the year ahead.

How To Estimate Electrical Work—I

YOUR ESTIMATE is a cost analysis. It deserves the precision of good bookkeeping.

YOUR ESTIMATE should reflect your known costs, not industry averages, nor the competitive situation, nor speculative possibilities.

YOUR ESTIMATE should be objective, realistic and factual, with personal judgments and guesswork limited to those areas where actual values cannot be predicted.

YOUR ESTIMATE should be methodical, clear, understandable to other skilled estimators. Your figure work should be checked completely by at least one other person.

WHERE can I obtain an accurate set of estimating units? Where can we find up-to-date estimating data? These and like questions are among the most persistent in the editorial mail bag. The questions seem easy, but the answers are not. Why? Because the questions themselves imply a need for knowledge of estimating methods.

First of all, *there is no* "accurate set of estimating units". The time for installing 10 feet of ½ inch EMT can vary from a few minutes to several hours. And what are "up-to-date estimating data"? Mechanics have no more thumbs or muscles than they had 30 years ago. Modern tooling and materials have influenced installation time in specific ways but estimating methods should stay substantially the same through the years. Good estimating techniques are necessarily adaptable to changes.

Are labor unit tables, then, of no value? On the contrary, they are indispensable to accurate estimating. But labor unit tables are set of average values from which specific experience can vary over an exceedingly wide range. Accuracy is therefore a matter of internal consistency. In an accurate set of units the estimator can be confident that all of the units are truly averages or vary by a consistent proportion from a true average.

For example, our units may say

½ in. rigid conduit	5 m.h. per c ft.
¾ in. rigid conduit	6.5 m.h. per c ft.
1 in. rigid conduit	11 m.h. per c ft.

The units are evidently consistent and thus useable. However, they are not necessarily exact for all conditions. It is much the same as the following analogy:

Television set	$300.00
Radio set	$100.00
Phonograph	$ 80.00

There are actually makes and models which can be purchased for the amounts shown. The values are consistent, that is, a $300 TV set is approximately of the same quality as a $100 radio. But actual individual purchases will range, for the TV set, between $150 and $1500.

The skilled estimator will see the unit for ½ in. conduit, 5 m.h. per c, not as a precise universal figure, but as a mark on a scale ranging from 3 m.h. per c to 10 m.h. per c at some point on which there is a precise figure which fits the work in prospect.

Labor Data Manuals

Most comprehensive of available labor data manuals is published by the National Electrical Contractors Association. It is in loose leaf form and the data are revised and augmented periodically. The manual is available only to members of NECA on a confidential basis.

A similar service is published by the Midwest Electrical Council and is likewise restricted to the members of that association.

These services are reported to be the most detailed sources of labor units available to any industry, with the possible exception of some local organizations, notably the Chicago Electrical Estimators, a group which has contributed very substantially to electrical estimating techniques.

Ashley's "Electrical Estimating" (McGraw-Hill Book Company) is a comprehensive work which contains in sample estimate form a very large amount of useful labor unit data, as well as the most thorough and practical description of modern estimating methods in print.

Many, perhaps most, contractors use their own labor unit data. These data are developed out of job experience or are variations of previously published data which has been amended to fit the specific experience or estimating techniques of the individual estimator. Sometimes the values approximate those in the NECA manual; often, however, they are far different. Most provide the basis for accurate estimates, which bears out the contention of many estimators that estimating skill and an understanding of the range of values represented are more important than the exact figure used to designate the unit.

Estimating Grass Roots

The job envelope of finished work is a prime source of useful data. It contains several sets of information for the estimator—

1. An exact material "take-off".
2. Tool time and changes.
3. Payroll information.
4. Precise job expense.
5. Progress information.

From this, by comparing with the original estimate, we can determine

1. Take-off errors.
2. Pricing errors.
3. Accuracy of labor units used.

The procedure is simple. Enter the material items from the job records on pricing sheets in the same order and arrangement as the original estimate. Extend the material items at actual cost. Apply the same (as estimated) labor units and extend. Complete the new "estimate", using the same multipliers or factors as in the original.

This procedure will be explained and described by example later in this series. It is introduced here to emphasize that "accurate" information is not derived from outside sources, but is built up by individuals from actual job experience.

A large proportion of electrical construction and installation work is negotiated on a lump sum price or quotation. Such quotations offer an assembly of hundreds of parts and components, engineering, expert technical and management services and skilled labor as a finished electrical installation. A quotation is normally based upon an estimate. Common business sense requires that the estimate should be an accurate and factual appraisal of the probable cost.

Bidding under competition often takes on the character of a personal contest. Some bidders are conservative, others take great risks. But the contest has no place in the estimate. Here we need facts, with known precision or known error.

The attainment of confident precision in estimating is no easy process. It takes a high order of engineering knowledge, skill and practical experience plus facility with the tools and data of estimating.

The accompanying article and those to follow will lay the groundwork for sound estimating procedures, methods and data. The emphasis will be on the small and medium sized projects where accurate estimating is needed most desperately today.

Further, no amount of industry experience data is properly qualified for your own estimating until it is thoroughly checked against your own individual experience.

Quantity Take-off

A detailed "take-off" of all the parts and components of the electrical system is a "must". For accurate estimating there are no short cuts which avoid this essential procedure.

How detailed? The nature of the job will determine. But a good generalization is—detailed enough to give at least 2 percent accuracy in materials and job expense and 5 percent in labor. Barring unusual and unpredictable job conditions, this order of accuracy is possible and practical on ordinary new construction projects of small to moderate size. On modernization and rewiring a somewhat larger error is to be expected, up to 4 percent on materials and 10 percent on labor.

To achieve such average accuracy, however, the estimator must have many of the job details "on the nose". Conduit and wire or cable takeoff cannot be made practically with 2 percent accuracy. Consequently, if average accuracy is to be better than 2 percent, other features of the take-off must be close to perfection.

For example, assume a small corner "taxpayer" of two stores and four office suites. What items can we expect to hit exactly? The following materials should be exact or very close.

1. Service bracket, service head, entrance conduit and wire, service el, service nipples, meter sockets.

2. Panels, circuit breakers or fuses, grounding fittings and bushings.

3. Pull boxes and junction boxes, load centers, ceiling and wall outlets, wiring device outlets and devices, multiple outlet assemblies.

4. Fixtures, signal equipment, and other fixed apparatus.

The wire and cable items will be less exact—

1. Load center feeders.

2. Branch circuit conduit, wire, or cable.

3. Signal wiring.

On modernization work it is more difficult to predict exact location of devices and circuit runs. Deviations from the original layout are more common, should be expected and allowed for in the estimate.

Some items are small in material cost but carry, in some estimating methods, relatively large labor units. A notable example is the locknut and bushing on conduit work or the connector on cable work. These are "terminals". They should be taken off with the same care as outlets.

On the branch circuit work, most estimators combine the terminal labor with the outlet. Since there is an average of two terminals per outlet, the locknuts and bushings on cable connectors can be approximated with considerable precision.

The precision of the take-off depends on two special abilities: 1) A thorough skill at reading plans and specifications and drawing essential data from them accurately and in detail. 2) An ability to visualize the actual work from the given data. These abilities come through experience. They are as essential in figuring single family dwellings as in multi story office buildings.

In organizing estimating procedure, however, a substantial part of the take-off can be made systematic or routine. And such routines are essential to cut down the possible take-off errors and to provide check points in the process.

TAKE-OFF PROCEDURE

1 **Read the specifications thoroughly.**

2 **Study the plans, check for plan notes.**

3 **Note items of major equipment (panels, motors, controls, bus systems, etc.) for which specific quotations are required.**

4 **Count and take off outlets and branch circuits.**

5 **Measure and tabulate feeders, service and power circuits.**

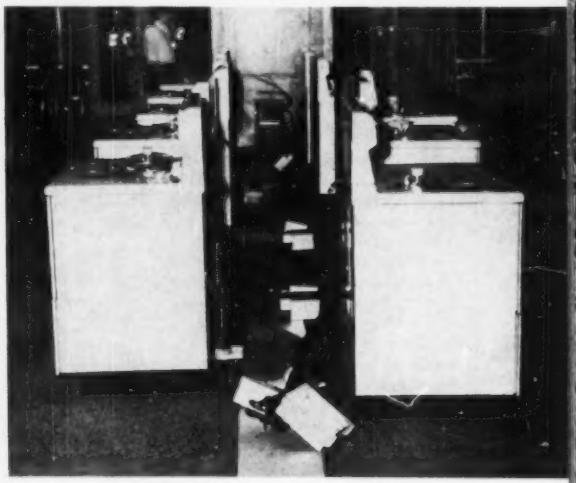
6 **Take off low tension wiring and equipment. Count and tabulate fixtures.**

7 **Recheck the specifications and plan notes.**

1 *Pre-assembled range assembly, complete with fuses and range receptacles connected into the feeder lines, is carried into the ballroom by S. J. O'Brien electricians.*

2 *Range assemblies were visually examined prior to connections by J. W. Barett, Waldorf-Astoria's assistant building superintendent, with G. E. engineers W. G. Short and J. D. Lowe.*

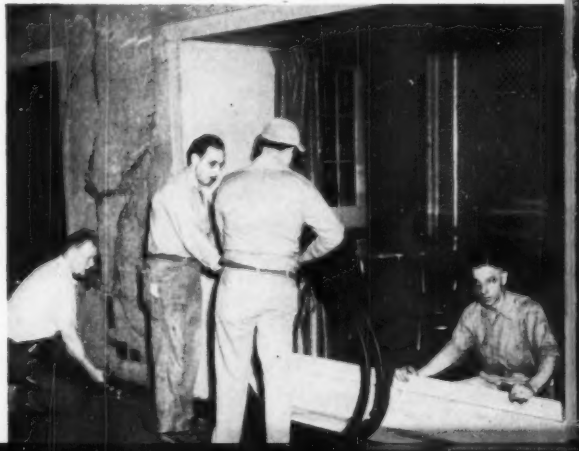
3 *Typical feeder for 10-range installation is unrolled across the floor of the ballroom prior to placement of the 100 push-button ranges used for the contest.*



4 *Ranges were then placed in position on either side of the feeders which contained pre-installed fuses and receptacles, a technique eliminating time-consuming on-the-job connections.*

5 *Auxiliary feeders were run from basement control board to ballroom panel; thence to branch circuits. Although working under pressure in tight spots, wiring was completed in five hours.*

6 *Pre-built wooden ramps were placed over cables running around ballroom perimeter, protecting cables from damage and contestants from tripping hazards.*



Ballroom assumed appearance of huge kitchen as army of electricians, engineers and porters moved the 100 ranges into position for the Pillsbury contest.

100 RANGES WIRED IN 5 HOURS

S. J. O'Brien, Inc., electrical contractors of New York City, convert ballroom of Waldorf-Astoria into huge kitchen for giant cooking contest.

PROBABLY the largest installation of electrical ranges ever connected for operation in one room was made in the grand ballroom of New York City's Waldorf-Astoria Hotel, Monday, December 12th, for a gigantic cooking contest sponsored by Pillsbury Mills.

Preparations for turning the ballroom into a huge cooking arena to accommodate the 97 women and three male contestants had to be completed by 8:30 a.m., although the actual installation of the ranges, together with all of the necessary wiring in the ballroom, could not be started until after 2:00 a.m. the same morning. The back-breaking task, however, was actually accomplished in five hours by electrical contractors, S. J. O'Brien, Inc., working in cooperation with T. J. Barrett, assistant building superintendent of the Waldorf-Astoria, and with General Electric engineers L. A. Mellem, J. D. Lowe and W. G. Short.

As the last of the waiters left the ballroom at 2:00 a.m., a small army of porters, electricians and engineers moved in and tackled the job of setting up 100 G. E. pushbutton ranges. By 5:00 a.m., power was on all the ranges and at 6:00 a.m. load testing of all circuits was started. At the 8:30 deadline, all was in readiness and workmen had departed.

Since the a-c supply taking care of normal ballroom requirements was deemed insufficient to supply the additional 450-kw. required, three extra services (3-phase, 4-wire, 500 MCM cables) were run from the main control board in the basement directly to the local panelboards on the ballroom floor. From these local panelboards, feeder assemblies (500 MCM, 4/0 and 6 AWG) were used to carry current to the ballroom and ranges.

Because of the critical time limit, these feeders were assembled and stripped beforehand, complete with fuses in the cable lines for each range, for each group of 10 ranges, and for each group of 25. A range receptacle was included in each range assembly so that it was unnecessary to make time-consuming cable connections on the job. And, to utilize the receptacle, each range was pre-equipped with a standard range cord set. Each range was also equipped with two special pilot lights to provide a quick, visual check on the operations of each range.

Although an apartment house installation of 100 ranges would normally be figured for a peak load of 100-kw., the wiring for the Pillsbury contest was figured for a maximum load of 450-kw., inasmuch as all ranges were to be used simultaneously.

Ten electricians from the O'Brien organization, together with the G. E. engineers, remained on constant duty throughout the contest to keep a sharp eye on the special pilot lights and to guard against any possible power failure. However, their assignment never passed the watchful-waiting stage for not a single range went out of operation during the contest.

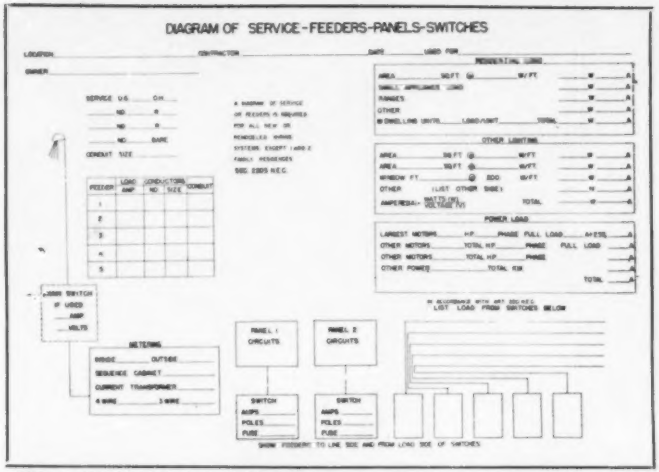


FIG. 1—PLAN AND DATA SHEET *issued to electrical contractors. Completed plan must be filed with and receive approval of the Electrical Inspection Department of the City of Pontiac before a permit will be issued.*

Electrical Inspection Control

How the Pontiac system of pre-permit wiring plans helps adequacy, coordinates the work of the electrical contractor and inspector; and boosts department efficiency.

By John W. Emerson
Superintendent of Electrical Department
City of Pontiac, Michigan

	60 Ampere Capacity			Over 60 Ampere Capacity			
	1947	1948	1949*	1947	1948	1949*	Total
Retail Establishments							
New	8	6	4	15	6	5	44
Remodeled	12	8	7	24	14	9	74
Residences							
New	0	0	0	0	0	0	0
Remodeled	5	10	6	17	5	10	53
Combination Residence and Retail							
New	0	0	0	0	0	0	0
Remodeled	4	7	4	4	2	0	21
Auto Service							
New	10	0	4	8	0	0	22
Remodeled	17	7	5	12	8	8	57
Miscellaneous							
New	5	6	8	15	2	3	39
Remodeled	15	7	13	30	10	6	81
TOTAL	76	51	51	125	47	41	391

* To Sept. 1, 1949

FIG. 2—BREAKDOWN OF PLANS *now on file with the electrical inspection department showing, in general, the type of work done in Pontiac.*

AT the beginning of the postwar period, the Electrical Inspection Division of the City of Pontiac, Michigan, inaugurated the policy of requiring a diagram of the service, feeders, panels and switches on all new or remodeled wiring systems with the exception of single or two-family residences.

Previous to this time, attempts to get plans for such wiring jobs resulted in delays, controversies and usually incomplete information. For example: One contractor installed an improperly sized service and lost a valuable account; another contractor, while changing the capacity of a lighting service, failed to combine it with a three-phase power service and left his customer with a choice of paying the initial steps of the block rate on two accounts or of again revamping the wiring to combine the services. The plan to be outlined, is an attempt to eliminate errors and miscalculations of this nature, and to establish a system of mutual benefit to all parties concerned.

In Pontiac, licensing of contractors and journeymen is handled by the Electrical Examining Board, consisting of one representative each of the contractors, journeymen, utility companies and industrial electrical departments working with the Electrical Inspector. In addition to approving licenses, this Board may adopt special rules and, accordingly, direct inspection procedure and policy.

The first step in clarifying existing ordinances and policy was taken in June 1945, when new regulations were adopted and published. Basically, the new requirements were:

1. When a building is substantially remodeled, the wiring system shall also be remodeled in accordance with the standards of the N.E.C. and the Ordinances of the City of Pontiac.
2. Any repaired portions of a wiring system shall also comply with the N.E.C. and Pontiac ordinances.
3. When additions to an existing wiring system are made, the branch circuit, feeder and service wires shall be made adequate for the load after additions are made. Should load increase necessitate rebuilding of services or feeders, the rebuilt portions of the system shall conform to N.E.C. standards and Pontiac ordinances.

In February of 1946, a special rule was adopted requiring a 60-ampere

(*Continued on page* 144)

FIG. 1—*Substation, 600 kva. is the largest of three, serves the Feldspar and Smelting rooms.*

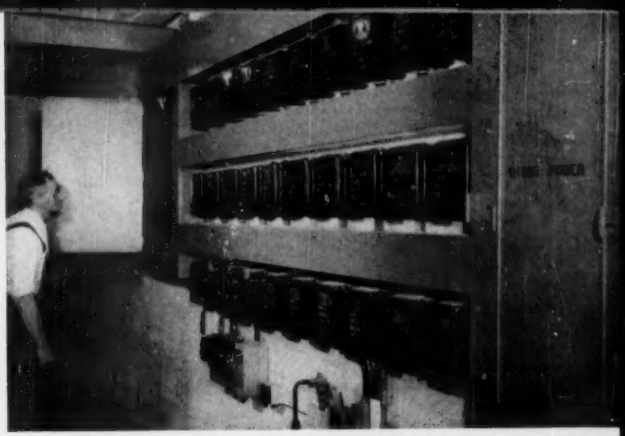


FIG. 2—*Control array centralizes controllers for individual motors on convenient and well planned wiring troughs.*

POWER MODERNIZATION

Distribution system at Ferro Enamel decentralized and capacity increased for ten times load growth.

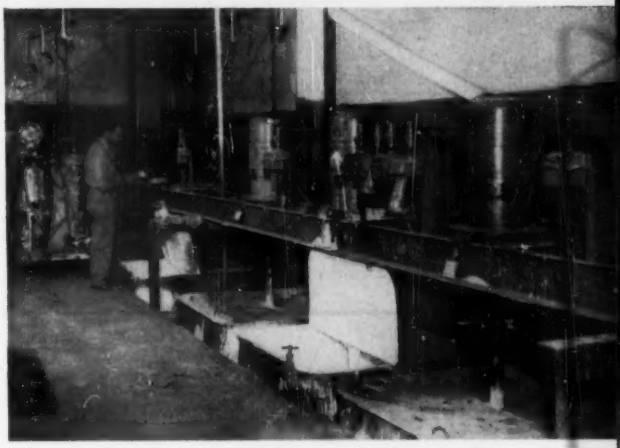


FIG. 3—*Typical of motor applications, vertical agitators are operated and protected by remote controllers.*

By Carl Reich* and J. T. Stone**

TWENTY years ago, Ferro Enamel Corporation of Cleveland produced 50,000 pounds of enamel coating per year; today the total is 8,000,000 annually. Originally, 300 hp. in motors was sufficient; today electric motors produce 3,000 hp. in the plant.

In the noraml growth of an organization, production and facilities increased together. War demands created tremendous pressures.

Although production was up, further expansion was being impeded by the inability of the existing power system to cope with extended manufacturing facilities.

Of primary concern to production chiefs in the "Frit" and "Vedoc" departments (enamel coatings) and to the electrical department, were stoppages in production due to short circuits. To provide a power system capable of dealing with present production facilities and flexible enough to allow for expansion, a complete investigation of the cost and means of modernizing the power distribution system was called for.

It was recognized that extension of the power lines to feed additional loads had resulted in a general overloading of all feeders and was causing unnecessary operation of the protective fuses. Also, each feeder was carrying a large number of loads which meant that, during each outage, more men and machines were idle than would be if the distribution system were properly planned. Hence, production was considerably reduced. Since outages often occurred when an electrician was not readily available, further production time was lost.

Again, the location of the old transformers at the front of the main group of office buildings presented a grotesque greeting to Ferro Enamel. Each new building added increased the load on the already over-extended distribution circuits.

To eliminate both these troubles it was decided to decentralize the distribution system and use three substations in place of one.

One of the requirements for the new equipment dictated that it be metal enclosed. The production of enamel creates a heavy dust which frequently coats exposed connections and switches and is one of the main causes of power outages.

Engineers proposed arranging the distribution system so that separate units would serve particular manufacturing areas with separate incoming power lines.

(*Continued on page* 146)

* Electrical Superintendent, Ferro Enamel Corporation

** Sales Engineer, General Electric Company

INSTALLATION: Woodhouse Stationery Co.
CONTRACTOR: Silverberg Electric Co.

Custom louvered ceiling, consisting of 2-in. x 10-in. wood members on 18-inch centers, finished off-white, shields 47 rows of 40 watt white lamps. Walls are grey, back wall green. Intensity: 120 fc. initially.

INSTALLATION: Moore & Day Motors
CONTRACTOR: E. C. Ernst

Fluorescent with prismatic lenses, reverse cove with fluorescent lamps, and louvered R-40 downlights provide effective decorative treatment and display lighting. Adjustable housed R-40's light windows. Intensity: 56 fc. average.

CONTRACTORS PUSH PLANNED LIGHTING

Electrical contractors in Washington, D. C. sell outstanding lighting installations.

By Berlon C. Cooper

SPARKED by a seven-meeting commercial lighting course in the spring of 1947, electrical contractors in the nation's Capitol City have been selling more and better lighting jobs. Typical examples are shown on these two pages.

Planned by an eleven-member Commercial Lighting Committee set up in the Electric Institute of Washington, this 1947 lighting course covered such subjects as Fundamentals of Lighting, Light Sources, Light Control, Lighting Equipment, and Selling Better Lighting. Average attendance at each meeting was about 100, with a total registration of 130, and was considered highly successful. Special follow-up meetings were planned and held during 1948. Early in 1949 a Commercial Lighting Design course was conducted under joint sponsorship of the Electric Institute and the Capitol Section of the Illuminating Engineering Society, the theme being "Let's Get Together". Registration for this practical course totalled 106, of which 70 were electrical contractors.

This lighting education program over the past two years, with emphasis on cooperation between the utility, manufacturers, wholesalers, and contractors, has resulted in better understanding and cooperation among the various groups, and a striking improvement in the quality of lighting jobs being installed in Washington.

In 1946 before this program got under way, a survey revealed that many lighting jobs were being sold without benefit of planning, particularly by the large group of small contractors. Commenting on this survey, Harold V. Oerting, Supervisor of the Lighting Service Bureau, Potomac Electric Power Company, said, "We have come to recognize that this large group of contractors represents the key men in the lighting industry. It is the electrical contractor in the final analysis who must sell and install lighting. He will sell the job up or down, depending on his knowledge and belief in the needs and advantages of good lighting. So it seemed that our most promising field to further the promotion of the best in lighting lay in this group, and in a comprehensive educational program to bring the group together with all others in the industry."

INSTALLATION: City Bank
CONTRACTOR: Biggs and Kirschner

Coves and coffers with cold cathode lamps provide soft lighting, and recessed prismatic glass lens downlights provide efficient work light. Ceiling is white, sidewalls blue. Intensity: 40 fc. on counters.

INSTALLATION: Sperling's Furs
CONTRACTOR: Silverberg Electric Co.

Two louverall sections with 40-watt daylight lamps combined with 150-watt R-40 louvered downlights provide good light for selling furs. Intensity: 40 fc. general, 100 fc. under downlights.

INSTALLATION: Stockett & Fiske Co., Inc.
CONTRACTOR: F. S. Bowen

Continuous row recessed troffers using three rows of 40-watt fluorescent lamps above prismatic glass lenses provide uniform lighting throughout. Troffers are hinged for relamping. Intensity: 42 fc. horizontal, 24 fc, vertical (average values).

INSTALLATION: Barton's Gift Shop
CONTRACTOR: Marshall Electric Co.

Continuous row semi-direct louvered units, with luminous sides, equipped with four rows of 40-watt fluorescent lamps, is surface-installed on ceiling. Floor and wall cases are lighted separately by fluorescent lamps. Intensity: 50 fc, maintained in service.

ELECTRIC RADIANT HEATING—V

How to apply heating panels to meet individual room design requirements.

IN the previous articles of this series, a small home was analyzed for its electric heating load. Each room was calculated for individual heat loss and the required wattage of heat panels indicated. The values found are recapitulated in the adjoining table.

It should be noted at this point that the type of building used for the example represents a fairly high ratio of heat loss to the enclosed cubic feet of space. Single story dwellings offer the greatest area of exposed surface for the contained space. Besides outside walls, each room has both ceiling and floor losses to outside temperatures.

The application of heating elements to each space involves matching the design requirements with practical arrangements of the elements. The design requirements should be used as a minimum. The actual installation will exceed design more or less for each area. Thus, the total installed equipment wattage will somewhat exceed the total design capacity.

The arrangement of heating panels described in the adjoining table comes practically close to the design requirements. With the two sizes and two wattages of the panels used for this example there are, of course, other arrangements which would achieve similar results.

The general criteria followed in the arrangements shown were:

1. Maximum use of the lower watts per square foot panels (17 w. per sq. ft.)
2. Placing of higher wattage (22 w. per sq. ft.) panels at or near windows, doors, outside corners.
3. Arranging panels in symmetrical patterns with rows generally following the room perimeter.
4. Exceeding the design requirements by a small amount in each area.

In ceiling panel heating, the source is a large area of relatively low temperature, a condition approaching the optimum for radiant heating. Location of individual panels or rows of panels under such circumstances is not critical since a large proportion of the total ceiling area is used.

A further article in this series will take up the application of radiant glass type panels to the same areas.

With such system, the total radiating areas are relatively smaller and due consideration must be given to the proper location of the heating panels.

Living Room - 25 x 15 feet, design 4100 watts

One window on each short wall.
16 panels around perimeter of ceiling

2-352 watt	4x4 panel	704 watts
2-264 watt	3x4 panel	528 watts
12-272 watt	4x4 panel	3264 watts
Installed Capacity		4496 watts

Dining room - 13 x 10 feet, design 1700 watts

Corner room, two windows
6 panels in two rows.

1-352 watt	4x4 panel	352 watts
5-272 watt	4x4 panel	1360 watts
Installed Capacity		1712 watts

Kitchen - 12 x 10 feet, design 1800 watts

Corner room, one window, one door
6 panels in two rows

3-352 watt	4x4 panel	1056 watts
3-272 watt	4x4 panel	816 watts
Installed Capacity		1872 watts

Hall - 15 x 4 feet, design 800 watts

One door at end
3 panels in one row

1-352 watt	4x4 panel	352 watts
2-272 watt	4x4 panel	544 watts
Installed Capacity		896 watts

Bath - 11 x 6 feet, design 800 watts

One window in short wall
4 panels in square at window end

4-204 watt	3x4 panels	816 watts
Installed Capacity		816 watts

Bedroom No. 1 - 15 x 10 feet, design 1900 watts

Corner room, 2 windows
8 panels in two rows

2-204 watt	3x4 panels	408 watts
6-272 watt	4x4 panels	1632 watts
Installed Capacity		2040 watts

Bedroom No. 2 - 11 x 9 feet, design 1200 watts

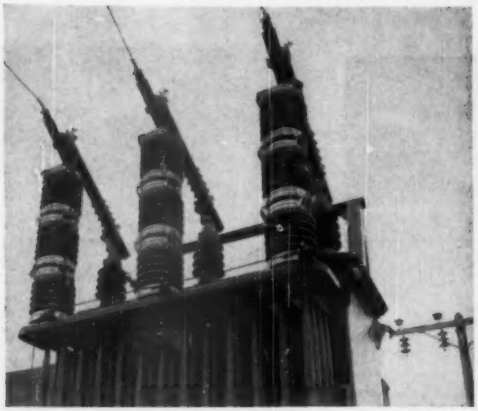
Corner room, one window
6 panels in two rows

4-204 watt	3x4 panels	816 watts
2-272 watt	4x4 panels	544 watts
Installed Capacity		1360 watts

TOTALS

49 panels

10—3 x 4 panels	204 watt capacity
2—3 x 4 panels	264 watt capacity
30—4 x 4 panels	272 watt capacity
7—4 x 4 panels	352 watt capacity
Installed Capacity	13,192 watts



LIGHTNING ARRESTERS *on 1500-kva. substation consist of a 3-phase set of Form G thyrite station-type.*

BATTERY OF FLOODLIGHTS, *mounted on boom of dragline at the Harmattan Mine, permit round-the-clock operation.*

MOBILE POWER PLANT

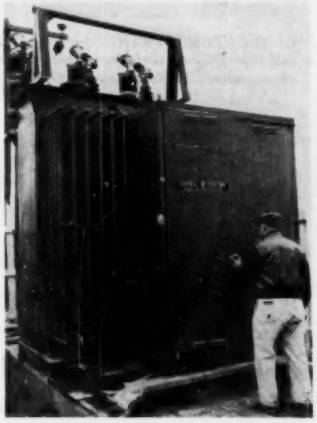
Skid-mounted substations and portable cables provide the solution to mobile mining requirements at Illinois collieries.

EFFICIENT strip mining requires mobile current. For draglines must be powered by heavy-duty scoop-pulling motors and, if round-the-clock operation is required, batteries of flood-lighting units must also be provided. Furthermore, as stripping areas move, power must be made available for these shifting load centers.

The answers to these specifications are found at the Harmattan Mine of the Fairview Collieries Corporation near Danville, Illinois, where the power distribution system includes a General Electric 1500-kva. outdoor-type skid-mounted substation, a grounding resistor, 3 single-pole thyrite station-type lighting arresters, 5 metal-enclosed portable hill-type cable skids, 4 cable skids of the pit type, and 20,000 feet of portable cable. So successful have been the results obtained from this initial mobile power distribution installation that a second dragline is now on order and, together with two more skid-mounted substations (one for standby use), should be in operation by mid 1950.

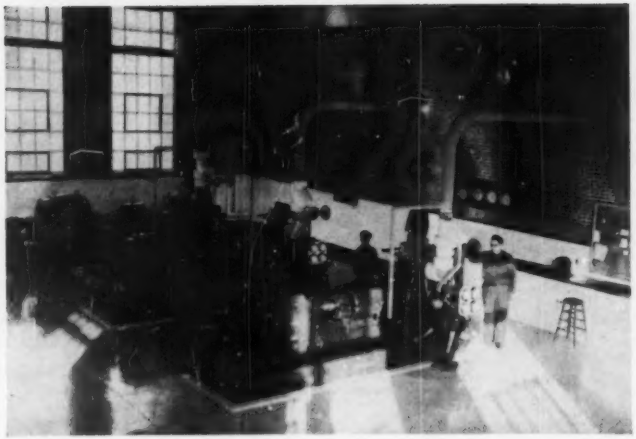
This is the first time that a coal-stripping power distribution system has included a means for testing ground continuity of each 4160-volt incoming and outgoing cable on hill-type skids, and definite time savings have been effected by eliminating the usual necessity of testing cables individually and frequently by the use of bell circuits. Safety is also furthered by the use of polarized couplers on each length of cable in order to maintain proper phase rotation. All cables (of the same type so that interchangeability is possible in emergencies) are grounded, with at least two ground breakers between each piece of operating equipment and the 1500-kva. unit substation.

With a maximum voltage drop of less than 5 percent, equipment can be operated at considerable distances from the substation and frequent shifting of units is thereby minimized. It is estimated that, after the second dragline has been placed in operation, peak 15-minute power demands may reach 2000-kw. and the plant should handle up to 600 tons of run-of-mine coal an hour. Conservative estimates place the plant's annual capacity at a million tons, and the mine's life at 30 years.



SKID-MOUNTED SUBSTATION *is integral unit single-circuit 1500-kva. outdoor type.*

HILL-TYPE CABLE SKID *is metal enclosed portable unit that can be shifted as stripping areas change.*

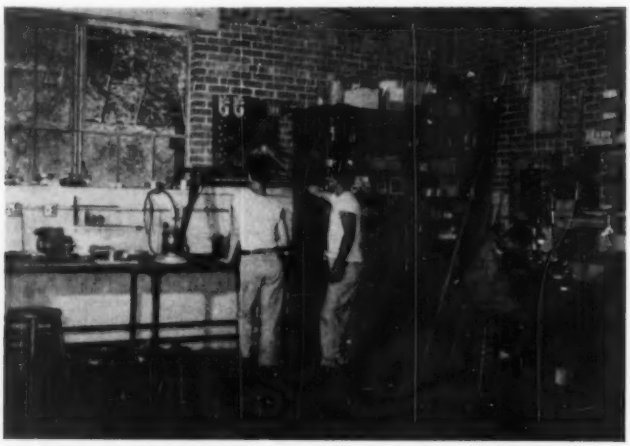


GENERATION *STATION for 2300-volt 3-phase 60-cycle service includes one 625- and two 375-kva. turbo-generators operated by steam at 275 psi. with 500 degrees of superheat. Boilers also provide steam for central heating system.*

ROADWAY LUMINAIRES *are cleaned and relamped by students assigned to the electrical maintenance department.*

Electrical System Promotes

Southbury Training School, dedicated to the rehabilitation of Connecticut's mentally deficient children, demonstrates the importance of a modern electrical system in promoting safety and contributing to an effective industrial training program.



ELECTRICIAN'S SHOP *is likewise an instruction center, with students learning the fundamentals of repairing and adjusting small appliances, reading meters and wiring diagrams, using electrical instruments and power tools.*

ELECTRICAL distribution and utilization—safe, simple and efficient—is proving a major factor in the rehabilitation of mentally handicapped children. For Southbury Training School, tucked away in a small scenic valley in southwestern Connecticut and dedicated in 1940, is receiving national recognition for an outstanding result-producing program of occupational therapy, a physical plant which is second to none, noteworthy completeness of modern equipment and facilities, a high degree of effectiveness obtained in utilizing this equipment for the reclamation of students (patients), and the all-out adoption of electrical applications.

In this latter respect, safety is primarily stressed. For the installation is designed to protect students from being physically injured by the electrical system and, conversely, it protects the system from both students and climatic hazards common to that section of the country. For example: underground distribution protects feeders from damage by ice and snow during severe winters and also protects students from possible contact with live circuits. Substations, vaults and flush wall panels installed for individual floors in all buildings are kept locked except for brief maintenance intervals. Plug fuses are eliminated in favor of auto-

DEAD-FRONT 12-CUBICLE SWITCHBOARD, *with both recording and indicating instruments, includes trunk breakers.*

TYPICAL ALL-ELECTRIC KITCHEN, *in one of the 30 cottages housing the students, indicates opportunities for instructing children in cooking practices, with complete safety from possible escaping gas or open flames.*

Institutional Safety

By Nathan C. Avery, Ph. B.
Supervisor of Plant Maintenance
Southbury Training School
Southbury, Connecticut

matic circuit breakers on all circuits serving student cottages. Switchboards are dead front construction, while mechanical guards are installed around all accessible equipment not otherwise protected. Main switches in all work shops are pulled at the end of each day.

Methods for control include safety-promoting relays and timing devices, thermostatic units, float and back pressure switches. And the institution's coded steam whistle alarm, operating through the main telephone switchboard and used to notify all employees of fire locations and other emergencies, is protected against "mischievous" false alarms by including call-back connections at all alarm stations so that switchboard operators can verify the authenticity of calls before electrically activating the remote steam whistle.

Also in the interest of safety and exact control, kitchens and bake shops are all-electric, with gas and open flames eliminated completely from these premises. This necessitates electric stoves and ovens and includes such diverse equipment as ice cream freezers and doughnut machines, food disposal units and refrigerators, dough mixers and bread kneaders, food choppers, meat grinders and slicers.

This wide acceptance of electrical operation is likewise evidenced on the institution's farm, in the dairy and laundry, shoe repair shop, printing plant, tailoring plant and barber shop where diversified equipment ranges from electrical chicken brooders and scalders to cloth cutters and sewing machines. The modern executive offices step up personnel efficiency through the use of electric typewriters and dictaphones, while student cottages and general assembly areas are served by motion picture equipment, radios, phonographs, television sets and other electrical facilities.

Electrical utilization is found in the modern hospital in the form of oxygen tents, radio diathermy and X-ray equipment. And some remote areas, such as the home of the farm foreman, are com-

[*Continued on page* 141]

MOTOR REPAIR SHOP *serves as vocational training aid, for certain students are permitted to assist maintenance engineers in cleaning, installing or repairing some of the institution's 500 motors.*

Ways to Lower Costs IV

Continuing a series on practical ways to expedite maintenance.

Meters provide accurate data on operating characteristics, making it possible to anticipate a fault, thus preventing a serious breakdown with resultant plant inefficiency and wasted man-hours, machine hours and production units.

36. Instruments

Electrical instruments are just as important to maintenance as are pliers, wrenches and screw drivers. They are stethoscopes for measuring the heart beats of the system and, without them, operating characteristics remain matters for guessing.

By analyzing instrument data, faulty operation can be intelligently diagnosed and immediate steps can be taken to prevent system shutdowns, reduce waste current and increase plant efficiency. Basic instruments include ammeters, voltmeters and wattmeters of sufficient range to measure the smallest and largest quantities of current, voltage and power handled by the system. Megohmmeters should be included for measuring insulation resistance and consideration should be given to split-core or clamp-on types of volt- and ammeters so that circuit characteristics can be measured while equipment is in operation.

While tools and instruments are essential to maintenance, the maintenance of the tools themselves should not be neglected. In large plants this is a major problem. For example; to keep over 10,000 universal-type 110-volt portable electric drills in constant operation at Consolidated Vultee's Fort Worth plant during the war, a separate division to the maintenance department was added to color-code, strip and wind, dip and bake, case-weld and test approximately 485 drills a day. Tools were repaired and rotated on a fixed schedule, few actual breakdowns were experienced, and production remained constantly high.

37. Plant Surveys

In addition to checking equipment and analyzing faulty conditions, periodic plant surveys can make major contributions to efficient operation and economical production by furnishing answers to such questions as:

Is operational continuity insured by the present service and internal distribution system?

Are there sufficient power outlets for quick changes of equipment layout?

Have load centers shifted?

Can loads be more evenly allocated over a 24-hour period?

Can idle machine time be reduced by changes in control?

Are spare units in stock sufficient to prevent delays in case of breakdown, or to provide auxiliary equipment for sudden expansion?

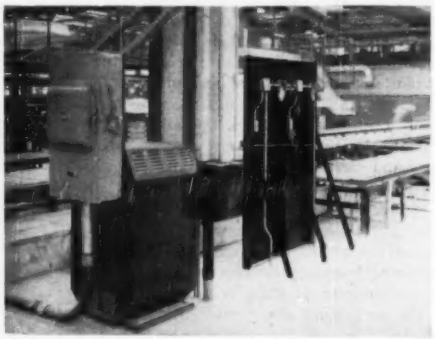
Would fan units or unit heaters make additional plant space available?

Would changes in control add to the flexibility of operation?

Some questions pertain to the plant as a whole, such as: Is the total electrical supply and load known? How can the power factor be improved? Is voltage maintained at points of utilization? Will a new distribution system, such as busbar, aid the plant operation? Are present feeders adequate and properly located through load centers? Is general illumination adequate and is emergency lighting provided? Are conveyors and industrial trucks used to their fullest extent? Are there sufficient outlets for hand tools?

Still other questions refer to machines, such as: Are they properly located? Can machine speeds be increased? Is the motor the correct type? Will limit switches speed the work? Can an electric hoist be used? Should lighting be altered? Are there bright surfaces to reflect glare? Can induction or radiant heating be used? How about the use of infra-red lamps? Can X-ray equipment be installed to detect hidden flaws in rough or finished parts?

While some of these questions, at first glance, do not appear to directly affect maintenance, all of them contribute to efficiency, economy, safety and ease of operation. And since these factors define the justification for maintenance, the questions rightfully belong in this category.



Air-cooled transformer (100 kva.) provides 110/200-volt power for electric range testing on final assembly line.

38. Local Transformer Applications

The length of low-voltage circuits can be held to a practical minimum by using local transformers, especially where small blocks of low-voltage power are necessary. Lighting loads can be fed from 460-volt feeders and circuits at several points without duplicating feeder runs; localized machine lighting can be fed from motor circuits; low-voltage power and test circuits can be served in a similar manner. Overall system installation and operating economies can be realized.

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Extra features—built into all National Electric Building Wires—are the "plus qualities" that make NE wire the most outstanding on the market today.

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(Types R, RW, RH)—Rubber insulated building wire that offers electricians clean handling.

- "Dilec" provides 100% covering of insulation
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14 - TW - 600V - National

THERMOPLASTIC

(Type TW)—A superior building wire for general use and wet locations.

- Moisture resistant
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- All National Electric Building Wires are clearly marked with size, type and voltage every two feet for ease of identification.
- NE Building Wires greatly exceed Underwriters' Laboratories, Inc. requirements.

Sold through leading electrical wholesalers

- This unique wire carton, original with NE, permits easy handling on or off the job. Simply remove the center circle, pull out the wire, cut off what you need. The unused wire remains in the box, clean and untangled.

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National Electric Products Corporation

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Now you have your choice:

- **the 4-ft. Slimline**
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- **standard 40-W lamps**
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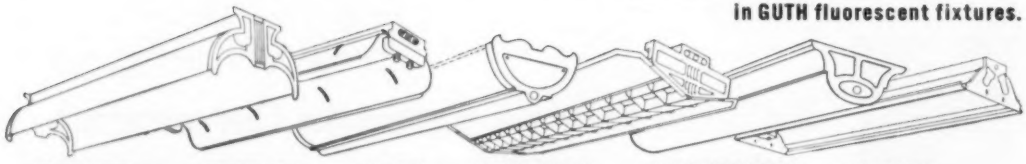
in GUTH fluorescent fixtures.



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IN
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143

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The RACO Line has won the wholehearted acceptance of Contractors—
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Championship of products in the building trades, however, has to be well earned. RACO's complete line of switch and outlet boxes has earned its top position on many counts—contractors depend upon the workmanship, quality, and careful inspection of RACO Boxes to insure quick installation. Architects know that RACO Boxes are dependable. The wide acceptance of the RACO Line assures wholesalers of quick turnover and steady demand. The RACO Line is approved by the Underwriters' Laboratories, Inc.

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"A BOX FOR EVERY NEED"

Practical Methods

Automatic Control Of Store Lighting

WIRING DESIGN

To control the lighting system in a Minneapolis fabric and furniture store, Langford Electric Company, Minneapolis electrical construction firm, designed a special automatic control circuit. The full length glass store front replaces the conventional show window and presents the entire store interior as a merchandise display. The owner wanted to take full advantage of the new lighting system as a sales and advertising aid. Hence, all outlets within the store area are controlled by a time switch that turns them on automatically at 6:00 PM and off at 11:00 PM (Saturday, Sunday and holidays included). Also integrated in the system is a remote control switch to facilitate operation and eliminate the hazards of forgetfulness.

A 32-circuit lighting distribution panel is fed through a 200-ampere, 3-pole, electrically-operated, mechanically-controlled remote control switch. This, in turn, is controlled by a single-pole, double-throw, astronomical dial time switch and a pushbutton station located adjacent to the lobby entrance on the first floor.

The pushbutton station is so connected that if the time switch is on an "Off" position, the station can turn the remote control switch either "On" or Off". However, when the time switch is on the "On" position, the pushbutton station has no control over the remote control switch. The remote control station is used to turn the store lights on in the morning and off at 5:00 PM during the week. Should the lights be left on at the end of the day, the time switch takes over at 6:00 PM and automatically turns them off at the pre-set hour of 11:00 PM. The system then reverts back to its normal operating cycle.

The accompanying circuit diagram shows the connection of the remote control switch, pushbutton and relay, and time switch. To better understand the operation of the circuit, follow the diagram.

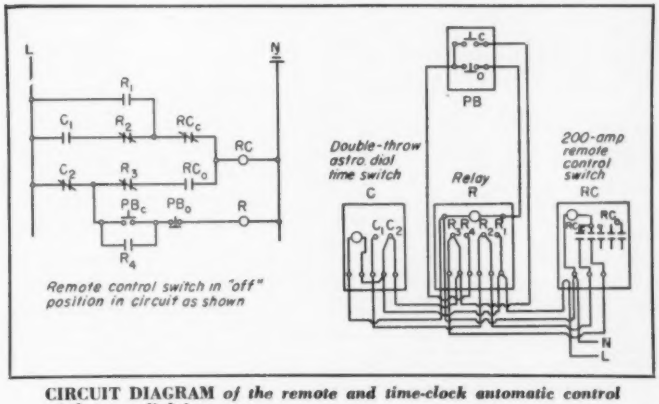
With remote control switch RC in an open position, pushing the normally-open button PB_o causes the coil of relay R to close contacts R_1 and R_4 and open contacts R_2 and R_3. The closing of R_1 completes a circuit from the line L through R_1 and RC_c energizing coil to the neutral N. This closes the main contacts on RC, and opens RC_c, and closes RC_o. The opening of R_2 and R_3 isolates RC from the clock control through C_1 and C_2. The closing of R_4 seals in the control circuit of relay R. This circuit is then made up from line L through C_2, R_4, PB_o, coil R to neutral N.

When the circuit is in the position described above and the normally closed button PB_o is pressed, the control circuit of relay R is broken returning contacts R_1 and R_4 to "Open" and R_2 and R_3 to "Closed". This returns the control of RC back to the clock through contacts C_1 and C_2, and completes the circuit from the line L through C_2, R_3, RC_o, coil RC to neutral N. This causes RC to operate opening the main contacts, opening RC_o and closing RC_c.

Should the remote control switch RC be open, then closed by operation of PB_c; and should the clock operate closing C_1 and opening C_2 (which would normally close R_c), this would open the control circuit of relay R, opening contacts R_1 and R_4 and closing contacts R_2 and R_3. This would leave contact RC_c energized on the line side as before, but now through contacts C_1 and R_2 and RC remains in the closed position. This also returns the circuit to the control of the clock which will open RC on its next cycle of operation.

When RC is in a closed position by virtue of the clock with contact C_1 closed, the push button station PB has no control over the circuit.

The owner has found this control system exceptionally convenient since it automatically handles Saturday and Sunday display lighting. He need never worry if the lights have been turned off at the end of the day. The time clock will do this automatically when it reaches the pre-set time, regardless of the position in which the system is left by the last person who leaves the premises.



CIRCUIT DIAGRAM *of the remote and time-clock automatic control of the store lighting system.*

Truck Tail Gate Is Also Power Lift

MATERIAL HANDLING

One of the prime goals of management at Dowzer Electric Machinery Works, Inc., Mt. Vernon, Illinois, is to eliminate most of the back-breaking drudgery normally associated with the handling of heavy motors, transformers and other electrical equipment. Not only is this good policy from the standpoint of employee physical welfare, but it pays off in increased over-all operating efficiency.

Dowzer uses electric hoists and underslung dollies for all equipment handling chores in the shop. The system worked so well that management extended power equipment to its trucking operations.

A semi-trailer truck is equipped with a Daybrook Power Tail Gate—a hydraulically operated device that lifts equipment from ground level to truck bed height. The tail gate drops to a horizontal plane, then lowers or raises as a platform; supports loads up to one ton; can be operated by a hand lever on either side of the rear truck bed.

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..., is a split-core Volt-Ammeter small enough, ...ght enough to slip into your pocket. And so low in price, it can be owned by every maintenance man, engineer, electrician, motor repair and service man. To use the Amprobe, just press the trigger to open the spring-controlled probe jaws; then release the trigger to close probe jaws around conductor. That's all you do to measure the current instantly, safely, accurately — *without interrupting the circuit.* A beautifully designed, precision-made instrument which can be subjected to rough handling without fear of breakage. Order the new Amprobe from your nearest distributor today! For descriptive literature, write Dept. E-10, Pyramid Instrument Company, 49 Howard Street, New York 13, N. Y.

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model A-5	model A-5-1	model A-6
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volts: 0/130/260 V. A. C.	volts: 0/150/600 V. A. C.	volts: 0/150/600 V. A. C.

frequency: 50-70 cycles • Accuracy ± 3% (of full scale deflection)
voltage breakdown test: 3,000 volts A.C. • Scale length: 2.47 inches

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PLATFORM LOWERS *to ground level, or any height, where equipment can be loaded. Beveled edge of gate serves as a ramp.*

LOCKED IN VERTICAL *position, the hydraulically operated platform serves as truck tail gate.*

Loading or unloading a truck can now be a one-man job. To load, the driver merely pushes the control lever. The tail gate drops to a horizontal position and lowers slowly to the ground. After the equipment is placed on the platform, the platform slowly rises to truck bed height. After the equipment is moved onto the truck, the tail gate swings to a vertical position and locks into place.

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With Whiz-Saw, no starting hole is needed. Whiz-Saw makes its own blade hole for inside cuts. Then it's a simple job to complete the opening. The Whiz-Saw blade makes close 1/4" turns and cuts all wood and composition materials up to 1" thick.

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The Klein Pocket Tool Guide showing the Klein line and containing useful tool information will be mailed on request.

Mathias KLEIN & Sons
Established 1857 **Chicago, Ill., U.S.A.**
1200 BELMONT AVENUE CHICAGO 18 ILLINOIS

Pulling Conduit in an Underground Duct

WIRING

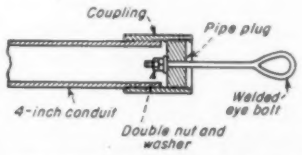
During a rewiring project in a Chicago industrial plant (formerly used for war production), Fischbach, Moore & Morrissey, Inc., Chicago electrical contractors, had occasion to install a 12-kv. underground feeder between an incoming switchroom and a new transformer substation some 650 feet distant. The feeder consisted of two runs of 4-inch conduit each containing a 3-conductor, 4/0 Okonite Okoprene cable. A major part of the run was straight with a right angle shift near the end to reach the new transformer room.

Paralleling the wall separating the switchroom from the plant area was an unused, underfloor concrete duct formerly connected to an air exhaust system. Fischbach engineers decided to install the dual conduits in this duct to a point opposite the new transformer location; figured the easiest way to do it was to *pull* the conduits in the empty duct area.

The concrete floor above the duct was opened for some 15 feet immediately in back of the switchroom. A similar opening was made at the other end of the duct, 550 feet away, at the point where the feeder changed direction to reach the transformer room. A steel cable winch with an ordinary power "donkey" was set up at this end. The conduit was laid in the duct at the switchroom end. The pull was made in 10-ft. "hitches" so a length of conduit could be coupled at the end of each hitch. After the first conduit run was installed, the second one was pulled in the same fashion.

Winch cable attachment to the first length of conduit was made by a welded eye-bolt fastened to the conduit through a threaded plug and standard coupling. The eye-bolt was inserted in a hole drilled in the center of the conduit plug and held by a washer and double-nut arrangement that permitted the bolt to turn with the steel cable as it was wound around the winch drum.

A wide sweep was made in the conduit runs where they turned toward the transformer room.



EYE-BOLT AND PLUG *attachment for pulling conduit run in concrete duct.*

Foolproof formula for fast delivery!
By ordering basic Electri-Centers and Pushmatics of the desired rating, you can . . .
quickly assemble the Pushmatics on the mounting rib and . . .
prepare the Electri-Center for installation in a matter of minutes.

Amazing *Pushmatics*® permit immediate local delivery on any Electri-Center

Now you can give customers immediate delivery on custom-made Electri-Centers with BullDog's new merchandising plan.

Under this unique plan, Distributors keep inventories flexible and deliveries prompt by stocking basic Electri-Centers and assorted Pushmatics. When an order is received, the Distributor supplies the desired Electri-Center and additional Pushmatics of the correct rating and type for quick assembly and simple installation.

Revolutionary Pushmatics are responsible for this improved plan. They are identical in size, regardless of rating or type, and are individually interchangeable. In fact, *Pushmatics are just as easy to order and install as fuses,* and offer a much wider range of types and ratings *plus* automatic protection and push-button switching for customers.

There's a Pushmatic to meet every load condition: THERMAL ONLY, THERMAL-MAGNETIC, and THERMAL-MAGNETIC with exclusive AMBIENT COMPENSATING FEATURES. All are identical in size and contour, in ratings of 15, 20, 30, 40 and 50 amperes, 120 V., 1 pole, or 120-240 V., 2 poles, AC.

Your customers have read about Pushmatic's amazing features. Your Distributor can make immediate delivery on any Electri-Center. Now is the time to follow through with installations!

PUSH—It's ON!

PUSH—It's OFF!

PUSH—It's ON again!

*Push-button switch with automatic protection for electric circuits

Look at these Pushmatic features!

- Simple to install; plenty of wiring room
- Individual single-pole units . . . easier to add or interchange than multiple units
- Positive protection against overloads and short circuits
- Trip-free automatic operation
- All types and ratings interchangeable
- Permanent tripping calibration by precision forming
- Approved by Underwriters' Laboratories

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In the new line of Cutler-Hammer safety switches, the tables are turned. For here is a switch mechanism designed to withstand *safely* any degree of heat that can be expected from correctly selected fuses.

So dependable in performance, so easy to install, so convenient to operate, so attractive in appearance are these Cutler-Hammer safety switches, alert contractors everywhere are featuring them, recommended by Cutler-Hammer wholesalers from coast to coast. CUTLER-HAMMER, Inc., 1500 St. Paul Ave., Milwaukee 1, Wisconsin.

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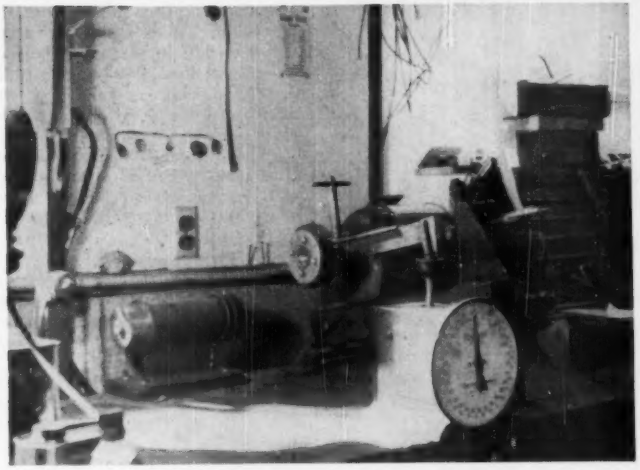
C-H

Motor Shops



Prony brake rig includes vise, brake embodying lathe chuck, and spring scale.

Simple Prony Brake Set-up

Three units are employed in this simple prony brake rig built by the Gory Electric Service, Los Angeles. First, at the right, is a vise of the type commonly used in automotive shops, adjustable as to height, which holds the motor rigidly during test.

Next is the brake proper, which embodies a lathe chuck to be clamped to the motor shaft. A steel brake band is made to bear on the outer surface of the chuck, the brake pressure being regulated by a screw. A brake arm one foot long is part of the brake band assembly.

The third unit is an ordinary spring scale. The outer end of the brake arm rests on the pan of the scale. The brake arm being one foot in length, when the motor shaft is turning the brake load reads directly in foot pounds on the scale.

Dip Tank Has Baking Hood

Most motor repair shops use the conventional dip-bake process. Normally, the work is pre-heated, dipped in a tank of insulating varnish, drained, and conveyed to a bake oven that is heated either by gas or electric strip heaters. Usually, the baking is done overnight after the oven has been loaded with a day's quota of rewind jobs. Some larger shops use the oven both day and night and many smaller shops operate a large oven overnight to bake only one or two pieces of equipment. Frequently, all shops have rush work on which delivery is sometimes delayed from 10 to 24 hours because of the baking process.

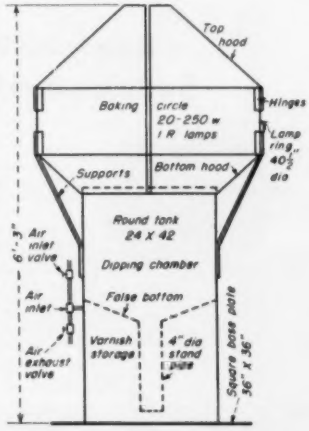
Last year, a new type of combination dip-bake unit was developed by Frank Willey of Willey-Wray Electric Company, Cincinnati, Ohio, and chairman of the Research Division of the National Industrial Service Association. The device combined an infra-red lamp ring above a forced-flow impregnation varnish tank (Sept. 1948 E C & M, pgs. 180, 182); eliminated many of the disadvantages of the conventional process; effected a substantial economy in dip-bake time for small motor work.

In the interim, Willey redesigned the unit to produce additional construction and operating refinements. The new unit, described in Bulletin No. 358 of the NISA Research Division, incorporates the lamp ring in a metal hood mounted to the top of the dip tank; confines preheating, dipping, draining and baking to a single piece of equipment; saves floor space; keeps surrounding floor area clear of varnish drippings.

Dimensions of the medium size unit (5 hp. to 20 hp. capacity) are: 36-in. square base plate; 24-in. by 42-in. high round tank; 40½-in. diameter lamp ring; 6-ft., 3-in. overall height from bottom of tank to top of lamp ring hood. The false bottom separating the tank dipping chamber from the varnish storage section has a 4-in. diameter pipe extension through which the varnish (under air pressure) enters the dipping chamber and returns to the storage section. This extension also accommodates armature shafts when such equipment is being impregnated.

The twenty 250-watt infra-red lamps in the baking circle are divided into two circuits, each operated by a time switch. Both circuits are used for the quick heat-up before and after dipping. When baking temperature is reached, one lamp circuit is cut out by the time switch. The other circuit completes the baking cycle.

Operation of this *vertical* dip-bake unit is simple. The work is held in the lamp circle for pre-heat (by suspension from a steel cable on a ratchet hand drum or similar method), then lowered into the empty dip tank. When the air inlet valve is opened, compressed air forces the varnish from the storage section up into the dip section. After total impregnation, the air exhaust valve is opened and the varnish returns (by gravity) to the storage section. This forced-flow action eliminates the need for stirring

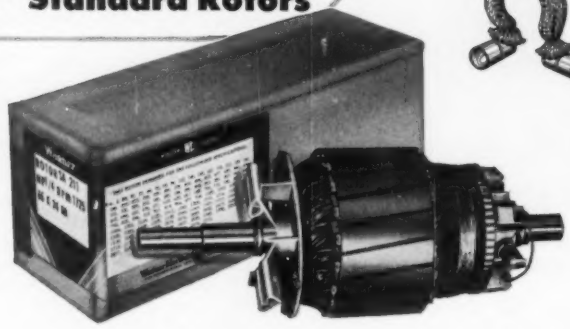


Dip-bake unit construction details. Note hood over dip tank that encloses infra-red lamp circle. Lamp ring has two hinged sections for loading and unloading unit.

Genuine Joe Says:

BE PROFIT-WISE

Stock Wagner Standard Rotors



It is often more economical to replace a burned-out rotor than to rewind it . . . small motors move through your shop *fast* and your winders are kept free for larger jobs that make more profit for you.

Rotor replacement is a simple 1-2-3 job when you keep a stock of Wagner replacement rotors on hand. The *exclusive* "tell-all" label on the Wagner Rotor Package, when used with Wagner's K & M specification lists, takes all the guesswork out of rotor replacement on Wagner motors.

Replace With Wagner Service Exchange Motors

BE PROFIT-WISE . . . Stock a few *new* Wagner Motors, too. You'll find many instances when a new motor means a ready sale.

You can build lasting customer satisfaction by keeping a stock of Wagner Service Exchange Motors on hand—for emergencies—for occasions when your customer needs immediate service—and for the replacement of motors that are "too far gone" to repair economically. Wagner Service Exchange Motors are fully guaranteed against defective material or workmanship for one year. The service exchange plan includes Capacitor-Start Motors from 1/6 to 1/3 horsepower and Repulsion-Start Induction Motors from 1/6 to 5 horsepower inclusive.

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or puddling the varnish to retain normal consistency. The work is then raised to the lamp hood for baking. Varnish drippings are caught in a pan placed over the dipping chamber.

Willey reports that the new unit cuts dip-bake process time from 60 to 75 percent. Typical figures are: Small unit (up to 3 hp. capacity) heat-up, 20 minutes; dipping, five minutes; baking, 60 minutes. About 100 percent more time is required for the medium unit (5 hp. to 20 hp. capacity).

Because it can handle only one job at a time, the unit cannot be used in large production processes. However, the short dip-bake time permits handling three or four jobs in an 8-hour day. Two or more sizes of units may be required in the average shop. Their construction and operating costs are inexpensive compared to conventional methods, and vent systems are unnecessary.

Mr. Willey's design and performance data are based on 18 months operation of a small unit and 6 months operation of a medium size unit. Resultant economies have led him to contemplate design of a larger unit. The conventional gas oven is still maintained in the Willey-Wray shop for work that can wait for overnight baking.

Copper Caster Faces Prevent Shaft Scoring

Hardened steel casters frequently score the finished surfaces of shafts when these shafts, supporting heavy rotating assemblies, are rested on the casters during repair or testing operations. Charles Zurbach, shop foreman

George A. Engelmann examines face of shaft to check for any possible scoring of surface due to extreme weight cutting into edges of supporting casters.

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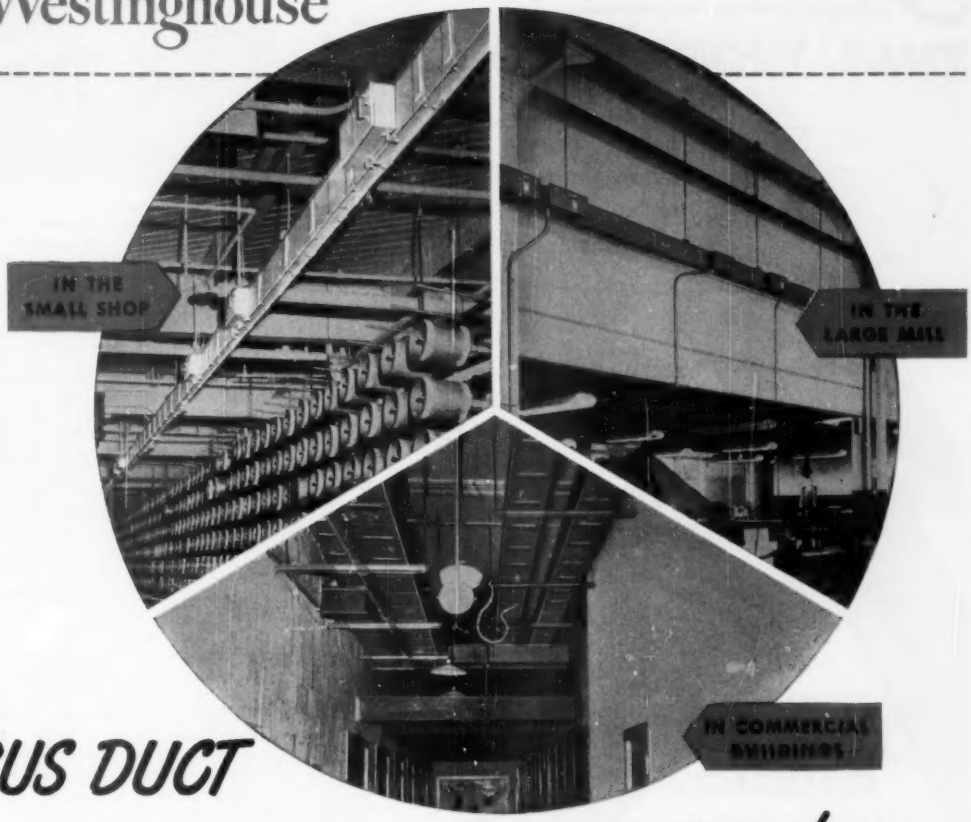
Westinghouse



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From the small machine shop, using only 20 or 30 feet of duct, to giant plants employing over 15,000 feet, bus duct makes a distinct improvement in secondary power distribution.

Automotive plants; metalworking shops; steel and textile mills; food processing plants; department stores; office buildings; these are only a few of the thousands of places enjoying bus duct's low-cost installation, reduced maintenance and availability of power where needed.

Operations can be expanded at any time without expensive rewiring and with minimum expenditure of time and labor.

Experienced Westinghouse field engineers are available to help plan your secondary power distribution system. For full particulars, phone your nearest Westinghouse office or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna.

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BUS DUCT

Guaranteed to save
TIME, WORK AND CASH

"The tougher the job, the tougher the tools have gotta be—for me that's RIDGIDs."

RIDGID's guarantee means no pipe wrench housing expense—at all, ever

● Workers everywhere like the work-saver features that make RIDGID the world's favorite. Housing is guaranteed against breakage or distortion. Adjusting nut spins easily in all sizes 6" to 60." Handy pipe scale on hookjaw. Instant-action non-slip, non-lock jaws. Powerful comfort-grip I-beam handle with flared end that won't let your hand slip off. RIDGIDs save your time and money. Buy them at your Supply House.

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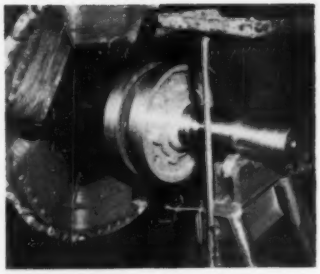
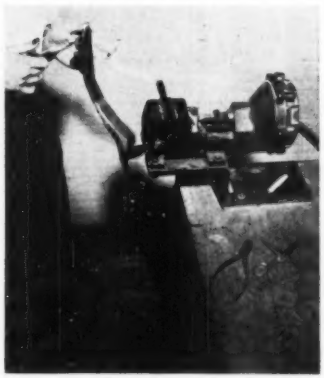


Copper facings on hardened steel casters, held in position by brass screws, provide relatively soft support for steel shaft. Tools and small parts are supported on tray mounted to vertical spindle which passes through stand-mounted sleeve.

for J. L. Hemphill, North Bergen, N. J., has found that this can be eliminated by facing the steel casters with copper sleeves or bands. The copper, being softer than the steel shafts, cushions the shafts without marring the surfaces and it then becomes unnecessary to refinish the shafts before shipping the repaired and tested assemblies out to customer premises. When this practice was first adopted, it was noted that the copper facings had a tendency to squash out and become loosened from the casters, so facings are now held in place by brass screws that enter the drilled and tapped casters.

The casters are mounted in pairs on stands formed from sections of 2-inch pipe, and small parts and tools are conveniently supported within reach of the electrician on a tray attached to the top of a slender spindle. This spindle is held vertical by a steel sleeve spot-welded to the side of the caster stand.



Air vises on benches of the coil department at Giles Armature and Electric Works, Inc., Marion, Ill., operate by foot pedal; free both of operator's hands for work; cut non-productive time to a minimum.

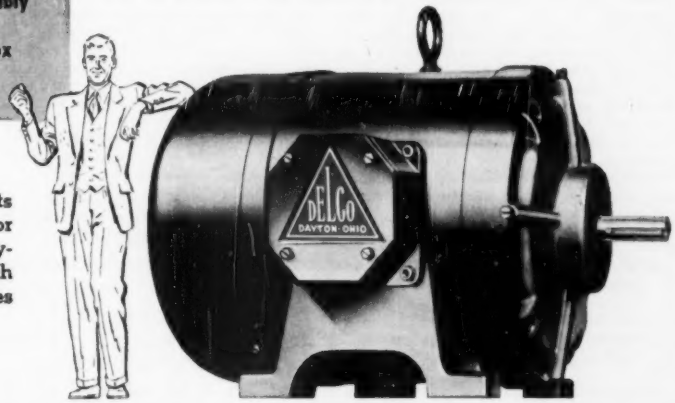
Heard the Word that's Going Round?

DELCO PREFERRED!

- Positioned Bearings
- Delcote Coil Insulation
- Corrosive-Resistant Cast Iron Frame
- Positive Lubrication
- Dynamically-Balanced Rotor and Shaft Assembly
- Water-Tight Conduit Box

Production Men Have Found the Answer to Better Motor Performance

There's no magic to it—just a motor that's built the way production men *want* their motors built. And more and more spec sheets carry the message "DELCO PREFERRED" to take advantage of the extra care and extra features that make Delco motors outperform all others. Here are a few of these *performance extras:*



Why not get all the facts on Delco motors? Phone or write Delco Products, Dayton, Ohio . . . or get in touch with one of the sales offices listed below.

DELCO MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

SALES OFFICES: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HARTFORD, CONN.

WIRING NEWS

A PERIODICAL DIGEST OF WIRING IDEAS FROM THE GENERAL ELECTRIC CONSTRUCTION MATERIALS DEPARTMENT

Dream-home Lighting For Every Type of Home

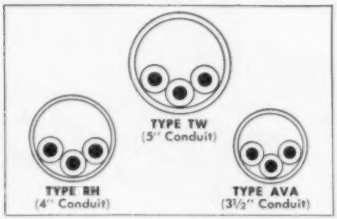
Today's prospective home buyers are harder to "sell." They insist on modern planning and conveniences . . . they look for extras . . . they demand proof of quality before they buy. That's why architects and builders recognize the value of the General Electric remote-control wiring system as a spur to added home sales.

This step-saving, new wiring system at last makes dream-home electrical control a reality. Simple and fast to install, it is easily demonstrated to the prospect. Unobtrusive flush switches at convenient locations give instant, positive ON and OFF control of any light or electrical apparatus. And, while you're demonstrating remote control, you'll have the added "sell" of the General Electric monogram.

For Low-Cost Homes

General Electric remote-control system is practical for even budget-price housing. Designed to fit in with existing techniques, remote control requires the same tools and methods needed to install present power circuits. You merely snap a small relay into knockout of outlet box. Inexpensive wire can then be run from relay to centrally-located transformer and conveniently-placed switches.

For further information why not contact your General Electric Construction Materials distributor, or check item (A) in the coupon below.



Here's How to Supply 49% More Current Per Raceway

Here's a really easy way to increase circuit capacity *without* increasing raceway size —just rewire with General Electric Deltabeston® asbestos-varnished cambric cables!

Insulated with heat-defying asbestos, Deltabeston AVA cables meet the requirements for small-diameter cables in heavy-load jobs involving high temperatures. That's why at normal ambient temperatures (in dry locations, as specified by National Electrical Code) AVA cables can deliver up to 49%* more current per raceway than ordinary types of building wires.

Saves on New Work

In new construction, too, because of their heat-resisting asbestos insulation, AVA cables often permit smaller conductors, reduced raceway sizes, and over-all savings on weight.

If you have not considered asbestos-varnished cambric cables for space and materials savings, you'll do well to figure them in on your next heavy-load job. It may amaze you to discover what real savings you can offer with Deltabeston AVA cables.

For further information, consult your local General Electric distributor or check box (B) in the coupon below.

** (This figure was worked out for AVA cables at 1000 MCM. Other sizes offer similar savings.)*

You Know You're Right With "G-E White"

There's no question about it. You get top wiring protection when you use General Electric white rigid conduit.

Carefully controlled in manufacture from raw material to final inspection, G-E White offers the advantages of a uniform, high quality product. Top-quality steel, *hot-dip-galvanized*, inside and outside, means years of protection from atmospheric corrosion. Smooth Glyptal® finish adds *plus* protection, makes wire pulling easy and fast.

During installation you'll appreciate the uniformity of G-E White. You'll like the way it cuts waste by eliminating flat bends. You'll like its sharp, clean threads.

For top protection use General Electric white rigid conduit. And remember General Electric also supplies a complete line of fittings and accessories. For information on conduit, check box (C) in coupon.

Light Weight Makes Light Work Of Residential Wiring

Light weight . . . small diameter . . . easy stripping. These features make General Electric PVX® nonmetallic-sheathed cable a real time saver in all types of residential work.

Glass-and-cotton braid resists both moisture and flame. Individual conductors are insulated with a Type T thermoplastic compound and spiral-wrapped with impregnated crushed-paper armor to provide maximum dielectric and mechanical strength. Check PVX at your local G-E distributor's, or check box (D) in the coupon.

Look For The Red Reset Button For Improved Lighting

For more satisfied customers . . . fewer call backs . . . make sure you replace worn-out fluorescent starters with General Electric Watch Dog® starters—the starter with the red reset button.

Watch Dog starters automatically cut failing lamps out of the circuit—eliminate annoying flicker and blink. They protect ballast and internal fixture wiring from expensive "burn-outs." So, when you specify or buy, be sure to ask for Watch Dogs!

Section K3-118
Construction Materials Department
General Electric Company
Bridgeport 2, Connecticut

Please send me free information on:

- A ☐ Remote Control
- B ☐ AVA Cables
- C ☐ White Rigid Conduit
- D ☐ PVX Cable
- E ☐ Watch Dog Starters

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Product News

Control Centers (1)

New standardized control centers containing motor starter units for the centralized control of groups of machines are available. Units feature plug-in type disconnects on the line side. They measure 20 inches wide by 20 inches deep, with heights in multiples of 14 inches for interchangeability in standard indoor structures either 76 or 90-⅛ inches high. Starter units can be mounted back-to-back in same structures. Starter units can be locked in a positive tilt-out position, disconnected from the line. New self-connecting Magna-Grip bus connectors automatically connect the line terminals when starters are inserted. Individual starter units are baffled from each other for added safety in keeping short circuits localized. All units are front-connected and front-wired.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Fluorescent Lamps (2)

A new line of fluorescent lamps for general lighting purposes has been announced. It consists of four lamps, two of which provide a cool atmosphere, and two a warm atmosphere. Each group contains a high efficiency or "standard" lamp, and a lamp of best color rendition, or "de luxe" lamp. Characteristics and uses of the lamps are—"Standard cool white" helps create a cool, crisp, atmosphere; gives equal emphasis to all colors; used in offices, factories, stores and schools. "De luxe cool white" for use where color needs are critical and best overall color rendition is important. "Standard warm white" combines the color impression of filament lighting with modern appearance and high light-efficiency of fluorescent; it emphasizes warm colors. "De luxe warm white" also combines color impression of filament with modern appearance and vastly improved color rendition; it is particularly desirable in social environments such as beauty shops, restaurants, shops and homes. The "de luxe" lamps available in 40-watt size, and they have an inner coating of "DR" phosphor, composed of a "double-activated calcium phosphate."

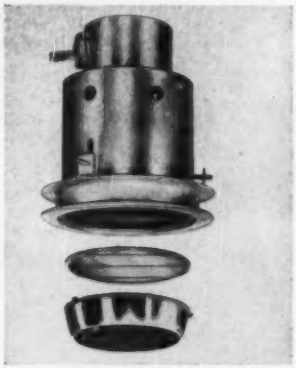
General Electric Company, Nela Park, Cleveland 12, Ohio

Instrument (3)

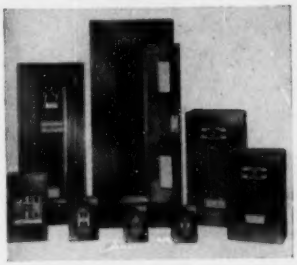
Model 29, a new 20 million megohmmeter, is an instrument designed for the measurement of electrical resistance over a range from 300,000 ohms to 20,000,000 megohms. The power supply is line voltage from 110 to 115 and 190 to 260 volts a-c. There are two test potentials of 85 and 500 volts d-c. A precision 6 inch edgewise meter is provided with a mirror scale and a knife edge pointer. The over all range of 300,000 ohms to 20,000,000 megohms is divided into six decades which are switch controlled.

Herman H. Sticht Co., Inc., 27 Park Place, New York 7, N. Y.

(4)



RECESSED "MIDGET-TOPLITE" ***fixture is for use with 75-watt R30 lamp and 100-watt standard lamp. It features steel plaster ring, squeeze type connector, 5 ft. leads, knockouts for extra wiring and accommodates "Midget Louver" and 777 Series color lens. Manufactured by Swivelier Company, Inc., 30 Irving Place, New York 3, N. Y.***



Multi-Breaker (5)

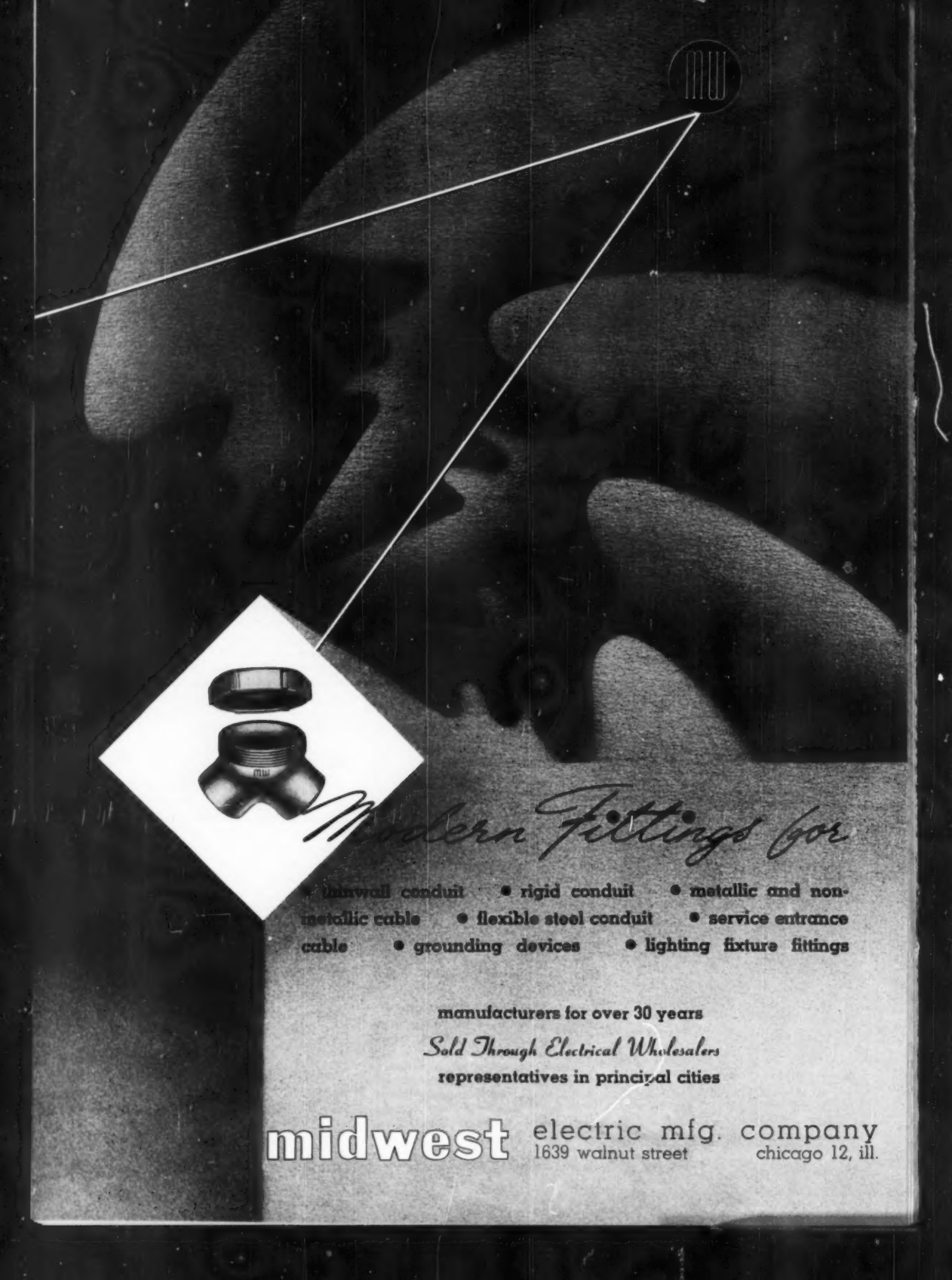
A new multi-breaker line to handle from 1 to 42 lighting and appliance circuits has been announced. The line features thermal (coiless) magnetic multi-breaker design, ranging from single circuit MO-1 up through MO-2, MO-4, MO-8, MO-12, MO-20 and NMO panelboard. MO-1, -2 and -4 cover circuit requirements for small homes. MO-8 "Ad-on" multibreaker (formerly known as MB-4 features single pole "ad-on" breaker unit. MO-12, MO-20 and NMO panelboards are designed for installation in large homes, commercial buildings and factories where a large number of circuits are required. Flexible "plug-in" multi-breaker units can be "plugged in" on round busbars, in 2 circuits steps, and additional circuits are needed.

Square D Company, 6060 Rivard Street, Detroit 11, Mich.

Conduit Bender (6)

A new hydraulic, remotely-controlled thin-wall conduit bender for 1¼, 1½ and 2 inch conduit sizes has been added to this line. It is known as Model S-34 and consists of the 10-ton S-71 hydraulic unit and the S-35 assortment of attachments. Features are—remote-control which enables operator to work safely at a distance and sight the bending progress from any convenient spot; all-directional operation which prevents air-binding in bending unit and enables operator to use bending frame in a vertical, horizontal or elevated position; extra utility when hydraulic unit is detached from bending frame and used with standard maintenance attachments as a general use jack. An electrically driven hydraulic P-182 pump is also available to power the S-34, S-30A and S-36 pipe benders.

Blackhawk Manufacturing Company, Milwaukee 1, Wis.


Modern Fittings for
• thinwall conduit • rigid conduit • metallic and non-metallic cable • flexible steel conduit • service entrance cable • grounding devices • lighting fixture fittings
manufacturers for over 30 years
Sold Through Electrical Wholesalers
representatives in principal cities
midwest electric mfg. company
1639 walnut street
chicago 12, ill.

Plug-In Strip (7)

A new Plug-In Strip with grounded receptacles has been introduced. It provides a spread of electrical outlets at either 6 in. or 18 in. intervals, and offers industries, stores, institutions and home owners the opportunity of plugging-in grounded or ungrounded portable electrical equipment in every receptacle. In addition to the conventional two slots in each receptacle, there is an adjacent third slot. Beneath this aperture is a copper insert that is mounted to the multi-outlet's steel base, affording a positive grounding facility. To achieve a thoroughly grounded electrical system, the Plug-In strip must be installed with a positive ground to earth. Type CF2-G has a 24 gauge steel channel enclosing the receptacle harness of two No. 12 insulated conductors.

National Electric Products Corp., Chamber of Commerce Bldg., Pittsburgh, Pa.

Electrical Insulation (8)

Quinorgo No. 4000 electrical insulation was specifically developed for use as a Class B (hot spot temperatures to 130C) electrical insulating carrier sheet to be combined with other electrical insulating sheets or films. Basically, this new No. 4000 is the same as Quinorgo No. 3000 introduced last year. Quinorgo No. 4000 contains a small amount of resin not present in No. 3000. This resin used with No. 4000 reduces absorption and penetration. Due to this, shellacs or other adhesive mixtures can be spread on one side of Quinorgo No. 4000 sheets without striking through to the reverse side. No. 4000 may be assembled with organic or inorganic electrical insulating sheets or films such as mica, glass cloth, plain or varnished cambric, Cellophane, rag and kraft papers. Available in continuous rolls in widths up to 36 inches and in sheets cut to size.

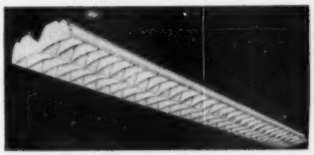
Johns-Manville, 22 East 40th Street, New York 16, N. Y.

Temperature Indicators (9)

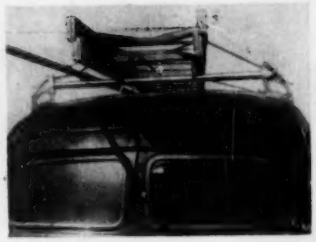
A new line of temperature indicators for industrial and laboratory use has been announced. Included in the line are cold-end compensated thermocouple thermometers for measuring temperatures up to 3000 F and resistant thermometers for temperatures up to 300 F. Thermocouple thermometer is available in two sizes: Type DO-71 with a 3½ inch flange and DW-71 with a 2½ inch flange. It can be used for temperature measurement in a wide variety of industrial applications, including galvanizing vats, melting pots, industrial furnaces, infrared drying ovens, oil quenching baths, ceramic kilns and salt baths for annealing. Designed for measurement of low temperatures where high accuracy is important, resistance thermometers are available in two standard types: DB-15 long-scale instruments and Types DD-6 and DD-7 six-inch rectangular, surface- and flush-mounted.

General Electric Company, Schenectady 5, N. Y.

(10)



THE "LUVEX" FIXTURE ***is for slimline lamps, designed for two 75-watt, 96 inch lamps, it is also available in sizes for two 72 inch, 60-watt slimline and two 48 inch, 40-watt slimline lamps. Ballast equipment is for 430 ma. "Luvex" is available for standard 48 inch, 40-watt fluorescent lamps. Fixtures are recommended for suspension mounting only and lamps can be removed through top opening. Manufactured by DayBrite Lighting, Inc., 5411 Bulwer Avenue, St. Louis 7, Mo.***



Rack for Trucks (11)

Announcement has been made of a new rack for panel trucks. It was designed for carrying ladders and other bulky equipment on panel trucks. Brackets are heavy polished aluminum casting, and crossbars are heavy wall aluminum tubing. Load carrying capacity is over 350 lbs., yet complete rack, installed, weighs less than 10 lbs. Four holes are drilled in the roof, and brackets are fastened with toggle bolts. A felt pad distributes the load evenly over 70 square inches of support area. A clamp on each bracket makes knots unnecessary. Clamps jam the line, and holds tighter as pull increases. Rope can be tightened from either side.

Stamford Casting Co., 804 Atlantic St., Stamford, Conn.

Insulated Screw (12)

The Forman insulated screw is a threaded fastening device with a plastic exterior and a metal core. The plastic portion of the head is not subjected to strain as the metal core carries the torque of the driving tool. The screw may be produced using any metal core including steel, brass and aluminum depending upon the application. The screw may be used to insulate against heat, chemical action, electricity etc.

Forman Insulating Screw Corp., 401 Broadway, New York 13, N. Y.

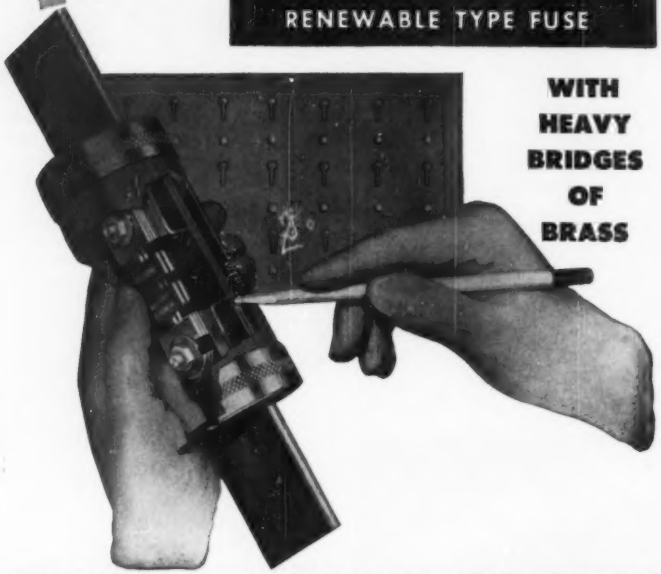
TO BE ANNOUNCED NEXT MONTH

New product items on which information was incomplete or too late to be included in this month's product news.

Hand tool for installing connectors on a wide range of conductors.
Column light for gasoline service stations and like applications.
Insulation Tester, rectifier operated for accurate testing of power and lighting installations.
Grounding receptacle to accept new grounding plugs or standard 2 prong plugs.
Time switches, a new series of clock operated switches for heavy duty.

NEW

Monarch
HEAVY DUTY
RENEWABLE TYPE FUSE



WITH HEAVY BRIDGES OF BRASS

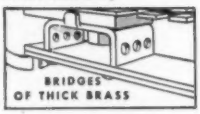
DESIGNED TO WITHSTAND TEMPORARY EXTRA HEAVY OVERLOADS

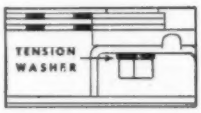
Approved by Underwriters Laboratory

Cool . . Truly Aligned . . Maximum Use of Brass . . . **Adding up to Lower Power Waste Than Ever Before!** ***And Here's How!***

This new heavy duty fuse incorporates many time-tested Monarch features. The newest, — thick brass bridges widely separating the terminals from the fiber bar and made with ventilating holes—allow ***maximum dissipation of any internal heat.***

The Monarch method of locking these bridges securely to the terminals and fiber bar, together with Monarch's positive lock construction and compressed tension washers, insures ***permanent true alignment.***

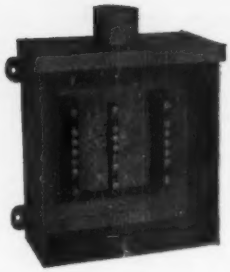




. . . IMPROVED SERVICE PER DOLLAR INVESTED

SPECIFY Monarch FOR SUPERIOR FUSErvice

MONARCH FUSE CO., LTD.
118 E. First Street Jamestown, N. Y.



Terminal Box **(13)**

No. 860 terminal box may be mounted on the service pole directly beneath main switch to which it is connected by a 1¼ inch nipple. Block is made up of three terminal bars, to each of which is connected one of the three conductors from the main switch. Underground cable are brought in through the bottom of the terminal box and attached to the terminal bars. Box may also be used at any remote point from the pole, being fed through the bottom with the top hub serving as an outlet for the load wires. It is weatherproof, made of galvanized steel, covered with gray enamel inside and out. Rating is 110-220 volt, 60 ampere. Dimensions are 8 inches high, 7½ inches wide, 3 inches deep.

Midwest Electric Products Company, Kankato, Minn.

(14)

NEW 96 INCH SLIMLINE LUMINAIRE, SL 1710 Series, has been announced. Egg crate louver is hinged from either side and side panels are Corning Alba-Lite. It can be either ceiling or pendant mounted, singly or in continuous rows. Slimline units can be supplied with 425 ma ballasts and new 75 watt T12 lamps. Sunbeam Lighting Company, 777 East 14th Place, Los Angeles 21, Calif.

Industrial Tape **(15)**

A new corrosion protection coating has been introduced. The new material, Polyken industrial tape, developed by Bauer & Black, saves in labor and equipment for corrosion protective operations, because it gives complete protection in a single operation, requiring

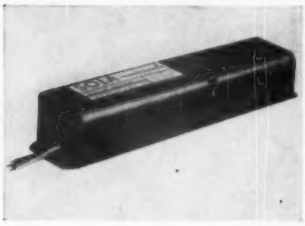
no heat or flame, no solvents or greases. Polyken is an oriented polythene film with a synthetic adhesive applied to one side, Polythene is a plastic which has electrical and chemical resistance properties. Polyken maintains a permanent pressure around the coated metal equal to the tension used in applying it; this pressure prevents the flow of moisture between the tape and the protected metal.

Plastic Engineering & Sales Corp., P. O. Box 1037, Fort Worth, Texas

Multi-Breaker (16)

Flexibility and protection for home electrical circuits are provided in the Ad-On multi-breaker, which has been announced. Combining both thermal and magnetic action, this unit provides protecting against overloads and short circuits. New circuits are added to make up the exact multi-breaker needed for any job requiring from four to eight circuits. Over 1000 circuit combinations from only 16 basic blocks and three sizes of Ad-On units are available. Basic unit breakers are rated 15, 20, or 30 amperes single pole; 15, 20, 30, 40 or 50 amperes double pole. Ad-On units are 15, 20 or 30 amperes.

Cutler-Hammer, Inc., 315 N. 12th Street, Milwaukee 1, Wis.



Fluorescent Ballast (17)

The "75" fluorescent ballast has been added to this line of lighting transformers. It is specifically designed for two T12 96 inch Slimline lamps. The design feature is the "Constant Wattage" characteristic. It is designed on the same constant voltage principle that is engineered into all CV transformers. The "75" with "Constant Wattage" design will maintain constant light output with a primary voltage range from 95 to 130 volts. It is also designed on a new principle of "Cushioned Starting", which requires less starting current than usual. The lamps are wired in series and started in sequence. Ventilated compartment for the capacitor is used.

Sola Electric Company, 4633 West 16th Street, Chicago 50, Ill.

NOW!
BEND THIN-WALL CONDUIT PROFITABLY

Hydraulic Porto-Power Brings You

• Spectacular Speed • Easy Operation • Fine Workmanship

At last — bend thin-wall conduit efficiently, profitably — thanks to Blackhawk's famous "Porto-Power" all-directional hydraulic unit. You sight progress of bending from the most convenient spot because the ram is *remotely-operated!* Make beautiful, kinkless bends, matched offsets and *rigid* installations in new record time. Handle 1¼, 1½ and 2" sizes. Create dramatic savings in materials. This low-cost, portable equipment pays for itself on your first good job. Present owners of Porto-Power Rigid Benders (10-ton hydraulic unit) need *only* buy the new thin-wall bending *attachments*. Order from your supply house today!

ALSO NEW!

Blackhawk's big line now includes a complete range of *Hydraulic Knock-Out Punches*. Miraculous performance. Get facts on Rigid Pipe Benders and all new equipment by writing today for Bulletin B-50.

BLACKHAWK

HYDRAULIC Porto-Power EQUIPMENT

BLACKHAWK MFG. CO., Dept. P-2010, Milwaukee 1, Wis.

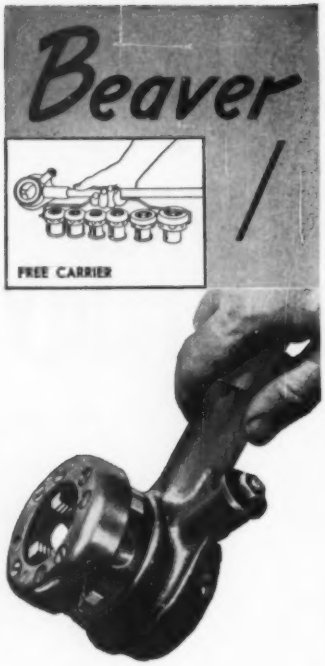
Without obligation, rush Bulletin B-50 giving full facts on Blackhawk's entire line of Electrician's Equipment.

NAME.....

FIRM.....

ADDRESS.....

CITY.....STATE.....



No. 3 Ratchet Threader For Pipe, Bolts, Conduit

Beaver No. 3 Ratchet Threader is a deluxe tool with fully-enclosed ratchet teeth that cannot get gummed-up or mutilated—thus eliminating the danger of serious accidents caused by ratchet slippage.

Die segments square in shape—no weak sections—are easily removable for sharpening and can be inverted for close threading. Ample openings between segments for oiling and chip clearance.

Diehead carrier free—enclosed metal tool-box available extra.

Beaver No. 3 threads Pipe, ⅛ to 1"; Bolts, ¼ to 1"; Conduit, ½ to 1"; Brass Tubing, ¾-20; ⅜ or ¾-27 Thread. Also specials.

Write for complete new Catalog No. 49 —free! It shows a complete line of hand tools, ⅛ to 12-inch; electric pipe & bolt machines, power drives, etc. Address Beaver Pipe Tools, Inc., 232-300 Dana Avenue, Warren, Ohio, U. S. A.

50 Years of Friendly Service

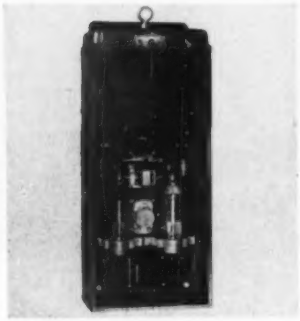
BEAVER PIPE TOOLS

Splice (18)

Announcement has been made of the production of a Straightline splice for ACSR (aluminum over steel) conductors, sizes No. 2 and No. 4. There are at present four items in this new line to provide for 7/1, 6/1 strand, in both No. 2 and No. 4 wire sizes. This type of splice requires no tools for installation on conductors. The outer tube is a hardened aluminum alloy designed to provide over-all resistance less than the same length of conductor. Steel core is bared for a distance of 3 inches; the core wire passes through a hole in the jaw washer and continues through hole in spring cup; the aluminum strand does not enter the nose of splice until the steel core is through the washer hole; aluminum then follows to the shoulder of the steel core jaw section.

Reliable Electric Company, 3145 Caroll Avenue, Chicago 12, Ill.

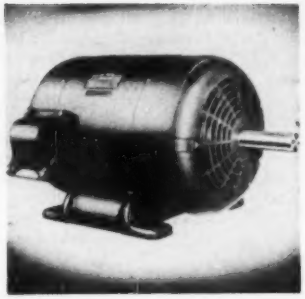
(19)



Rectifiers

New 2T Series of single phase temperature-free tube rectifiers has been announced. They are designed for use in conjunction with such equipment as electromagnets and separators, machine tools, printing presses, electrolytic equipment, alternators, dynamometers, electrical testing equipment, and any industrial requirement where direct current is necessary. They employ xenon gas-filled tubes for ambient temperature limits of -40 to 125° F. Dual a-c input voltages, 115/230 or 230/460 volts. Available d-c outputs are 115 volts or 230 volts, in capacities ranging from 115 watts to 3680 watts. These units incorporate insulated filament transformers, synchronous motor timer, fuses and terminals, mounted on ebony panelboard, pilot light on face of cabinet, and insulated anode transformer. Wall mounting housings are steel, louvred, and having knockouts for conduit connections.

Accurate Engineering Company, 2005 Blue Island Ave., Chicago 8, Ill.

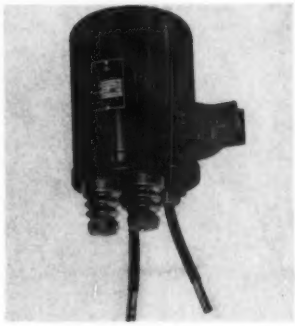


Explosion-Proof Motors (20)

New squirrel cage, totally enclosed, type CSP, explosion-proof Life-Line motors are available. Heavy steel construction is used for resistance to corrosive atmospheres. Motors are designed for constant speed drive applications, such as pumps, blowers, or compressors, and may be used in any location where Class I Group D explosive materials or atmospheres are encountered. They are available in frames 224 to 326, in 1-to 20-hp. ratings, for 2 and 3-phase, 25, 50, 60 cycle, 208, 220, 440, 550 volt service.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.

(21)



Transformers

Announcement has been made of new Stancor transformers designed to operate in series street lighting circuits of the constant current type, each unit inductively coupling the high voltage series circuit to an individual incandescent lamp operating at a low voltage and high current. Two types are available—SSLP for pole mounting and SSLV for vault and manhole mounting. The vault or pole base type permits the installation of high voltage, high efficiency series circuits in areas where high voltage conductors are not permitted above ground.

Standard Transformer Corporation, 3580 Elston Avenue, Chicago 18, Ill.

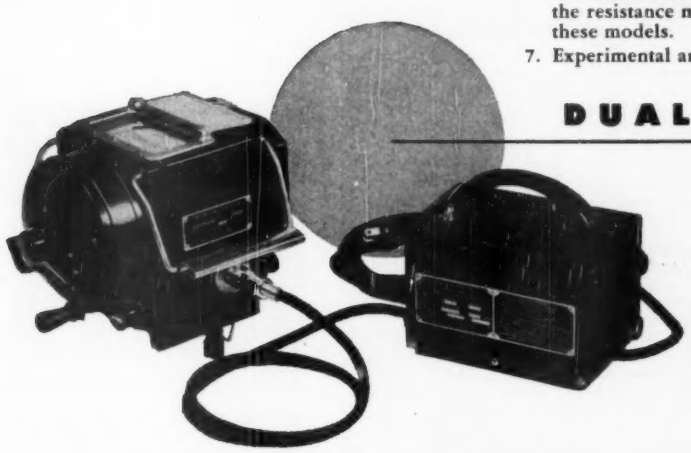
NEW "MEGGER"* Rectifier-Operated Insulation Testers

RECTIFIER-OPERATED

. . . in which a transformer and rectifier replaces the usual hand-cranked generator. It operates simply by plugging into 115 v. 60 cycles.

Typical Applications include:

1. Production testing of all types of electrical equipment and components.
2. Testing multi-conductor communication cables, as in telephone plants.
3. Testing multi-conductor control circuits in power plants.
4. Acceptance tests, such as from load centers, in lighting and power installations.
5. Testing multi-conductor control and power circuits at central locations in railway signal installations.
6. Testing generators, cables and other equipment by the time-resistance method, where the dielectric absorption or leakage current of the insulation under test is high enough to bring the resistance measurement within the range of these models.
7. Experimental and laboratory use.



DUAL-OPERATED

. . . a combination of the popular, constant-voltage, hand-cranked set, and a separate rectifier. It can be operated either by hand or by the rectifier connected to 115 v. 60 cycles. This Dual-Operated instrument has the same applications as the instrument above, *plus* the fact that the basic, hand-cranked instrument is available for test problems normally encountered in the field.

• *For full particulars please write for new illustrated* **Bulletin 21-46-ECM.**

*REG. U. S. PAT. OFF.

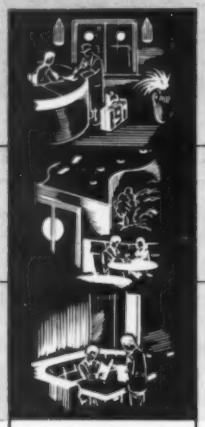
JAMES G. BIDDLE CO.

Electrical & Scientific Instruments

1316 ARCH STREET, PHILADELPHIA 7, PA.

"Megger" INSULATION TESTERS • GROUND TESTERS • OHMMETERS

How to keep PATRONS PLEASED

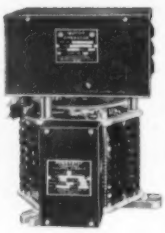


in

HOTELS

LOUNGES

RESTAURANTS



DM2000

DBP3-2000

Patrons expect atmosphere — whether it's the dignified affluence of a hotel lobby, the warm intimacy of a cocktail lounge or the flattering comfort of a restaurant. One way to keep them pleased — and coming back — is to create the atmosphere they seek. And the dimming, brightening and blending of light can play an important part in achieving that atmosphere so pleasing to the discriminating patron.

POWERSTAT LIGHT DIMMING EQUIPMENT can lift any lighting system out of the ordinary into the unusual. With it, one can raise, lower or blend lighting to suit any occasion — can obtain lighting effects so pleasing to patron and complementing to decor. For instance, the unit at upper left handles single circuit loads of up to 2,000 watts of incandescent or cold cathode lighting — is motor-driven for handy pushbutton, remote operation. It's easy to install and economical to operate over long periods of constant use.

The "packaged" POWERSTAT Dimmer at the left handles a total of 6,000 watts. Each of its 3 units handles a separate, 2,000-watt circuit — gives "big switchboard" performance in one low cost, portable unit.

There's a POWERSTAT Dimmer, manually-operated or motor-driven, for every lighting control need. Investigate them today — whether you're planning a new building or starting renovation.

THIS BOOKLET — FREE, OF COURSE — IS FULL OF INTERESTING INFORMATION ON THE COMPLETE LINE OF POWERSTAT DIMMERS. SEND FOR IT TODAY — YOU'LL FIND IT A HELPFUL ADDITION TO YOUR FILE ON LIGHTING CONTROL.

6010 Demers Ave.
BRISTOL
CONN.

THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT

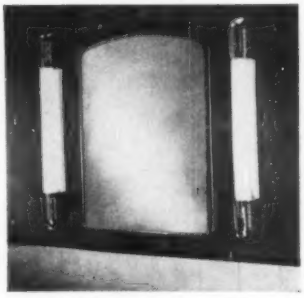
POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS

Span Scaffold **(22)**

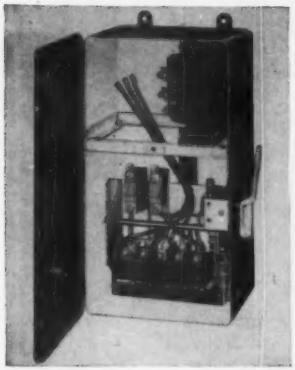
A six foot span scaffold, consisting of three parts, has been added to this line. Platform assembly has pivotable, extendable diagonal braces which when in use swing into latching position on underside of assembly. Each ladder frame assembly is complete with adjustable legs and either casters or rubber end cups as desired. Platform has locking hooks which snap onto the rungs of the ladder frames at desired working level. Scaffold has been designed for contractors, stores, offices, factories and home owners.

Upright Scaffolds, Division of Up-Right, Inc., 1013 *Pardee St., Berkeley 2, Calif.*

(23)



FLUORESCENT BATHROOM LIGHT *is available with and without a convenience outlet for plugging in electric shavers, heat lamps or other appliances. Fixture contains a 14-watt fluorescent lamp, chrome end pieces and white reflectors. Units can be installed close to wall. It measures 21 inches in overall length and is also suitable for lighting hallways and breakfast nooks or can be mounted horizontally to fit under kitchen cabinets, over range. Manufactured by Sylvania Electric Products Inc., 500 Fifth Avenue, New York, N. Y.*



Starter **(24)**

A new manual, autotransformer-type starter for squirrel-cage motors has been announced. It is available in four sizes from 5 hp, 220-440-550 volt to 250 hp., 440-550 volt; for 25, 50 and 60 cycles. Switch mechanism operates with a quick-make, quick-break action. Two automatic reset overload relays are standard equipment. The new line comes in two forms—Form T, with air-break contacts; and Form X with oil-immersed contacts. The airbreak form can be converted to oil-immersed operation by adding a standard oil tank that is supported beneath the switch.

Allen-Bradley Co., Milwaukee, Wis.

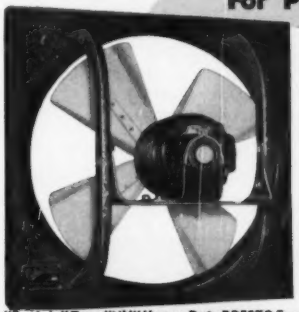
Meters **(25)**

Announcement has been made of single phase watthour meters for house service that employs unit construction of all four major assemblies: base, electro-magnet, damping system and register. This construction permits the meter to be kept in step with load growth since current and potential coils can be replaced with coils of other ratings. Type S-3 meter, which is available in 2- or 3-wire single phase 5- or 15-amp. rating for 120- or 240-volt service may be had with either clock type or cyclomotor registers.

Roller-Smith, Bethlehem, Pa.

Wherever Fresh Air is NEEDED

"Buffalo" Panel Disk Fans are the Choice For Economy — For Performance



"Buffalo" Type "NV" Heavy-Duty BREEZO Fan

"Buffalo" Panel BREEZO Fan

THROUGHOUT industry, thousands of "Buffalo" Disk Fans are doing a quiet, steady, ECONOMICAL Job of improving working conditions. Their square panel construction makes them easy to install wherever you need to draw off fumes, heat, smoke, steam, stale air. First cost for these husky, efficient fans is low—and operating cost is almost negligible. Above, a "Buffalo" Belt-Air Fan maintaining fresh air in pump room. For smaller-area "spot" ventilation, the "Buffalo" BREEZO is ideal, while the Heavy-Duty Type "NV" Breezo is designed to work against up to ¼" duct or other resistance. Write for Bulletin 3222-F for all the facts on these practical, universally-popular fans.

"Buffalo" FANS

BUFFALO FORGE COMPANY

520 Broadway Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in All Principal Cities

Heavy jobs and light jobs—the new 250-watt Weller Soldering Gun speeds them all. Chisel-shaped RIGID-TIP provides more soldering area for faster heat transfer. New "over-and-under" terminal design gives bracing action to tip. Your Weller Gun does delicate or heavy soldering with equal efficiency; compact and lightweight, it gets into the tightest spots.

Weller Guns actually pay for themselves in a few months. Fast 5 second heating means no time lost. Trigger-switch control means no current wasted —no need to unplug gun between jobs. Prefocused spotlight and longer length let you *see* the job and *reach* the job with ease. No other soldering tool offers so many time-and-money-saving features. Order your new 250-watt Weller Gun from your distributor today, or write for bulletin direct.

SOLDERING GUIDE

Get your copy of "SOLDERING TIPS"—new fully illustrated 20 page booklet of practical soldering suggestions. Price 10c at your distributor's or order direct.

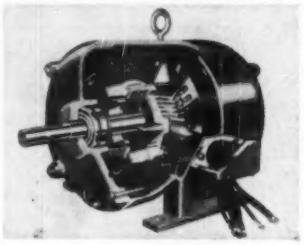
WELLER MANUFACTURING COMPANY

815 Packer Street, Easton, Pa.

Floodlights (26)

A new line of floodlighting units for farm and home, coupled to a new G E remote control has been announced. Single two lamp and three lamp units embodying the Steberlite lampholder for PAR-38 reflector-type lamps are available. Any number of remote control switches may be installed at convenient locations around the farm or home, and lights can be turned on or off from any of these points. Switches operate on 24 volts, provided by a transformer which is an integral part of the remote control. Three-wire switches provide positive indicating "Off" and "On" switching. Low voltage switch wire may be run underground or overhead. The same wire is used for indoor wiring without conduit or switch boxes.

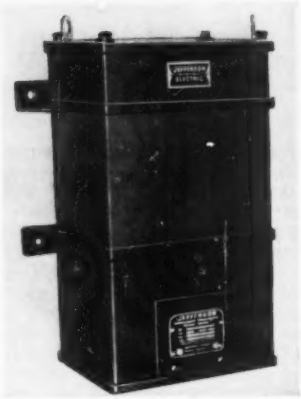
Steber Manufacturing Co., Broadview, Illinois



Motor (27)

A new squirrel cage induction motor has been developed. Ventilation system has been designed to eliminate hot spots. Ribs supporting core on the frame are open in center, permitting air to circulate around and cool back of core. Heated air is exhausted laterally through the baffled feet away from the air inlets. The closed underside of frame prevents escape of heated air under motor where it would be picked up and recirculated. Steel frame is continuous and gives protection on bottom as well as on top and sides. Air inlets and outlets are baffled to meet NEMA specifications for drip-proof protection. Available with either low voltage or high voltage windings.

Ideal Electric and Manufacturing Co., Mansfield, Ohio



Transformers (28)

This line of power circuit transformers has been expanded to include 7½, 10 and 15 kva. sizes, which provide the lower voltages for lighting circuits, appliances and small electric tools, relays, controls, etc. These double-wound transformers are of the dry type with mounting brackets and loops for hanging. Wiring compartments are provided for both primary and secondary connections with ½ inch and ¾ inch knockouts. Primary voltage is 460/230, secondary 230/115 volt; 50/60 cycle.

Jefferson Electric Company, Bellwood, Ill.

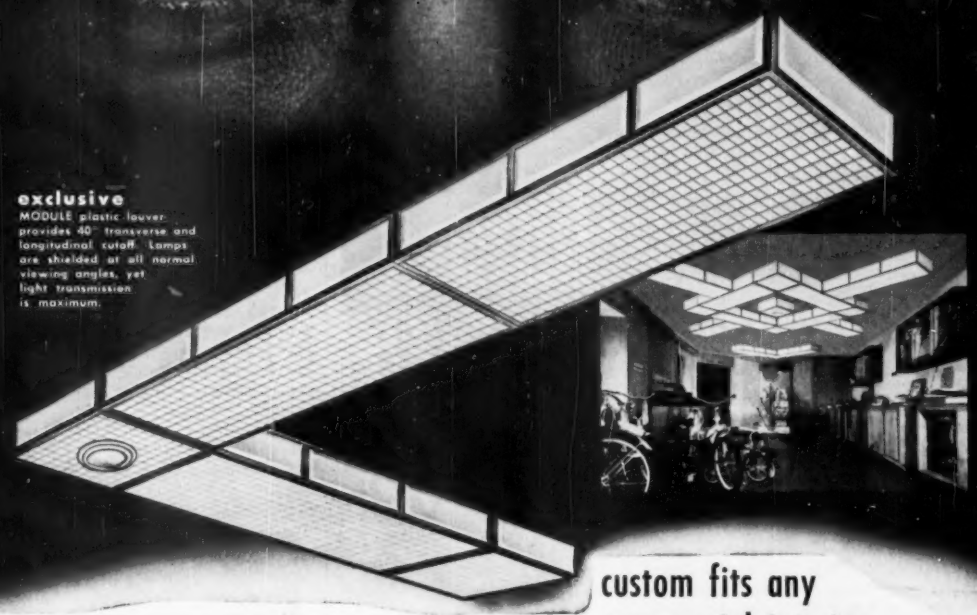
Fluorescent Sun Lamp (29)

A new fluorescent sun lamp for use in homes, schools, offices, factories, hotels, recreational areas, gymnasiums, hospitals, or any other interior has been introduced. Available in either 20 or 40 watt sizes, it is identical in dimensions and electrical operating characteristics with standard fluorescent lamps. Long and tubular in shape, the new device emits radiation over a large area with an output concentrated in the mid-ultraviolet wavelengths (2800-3200 Angstroms). A sofe blue light of low visibility is produced by the lamp.

Westinghouse Lamp Division, Bloomfield, N. J.

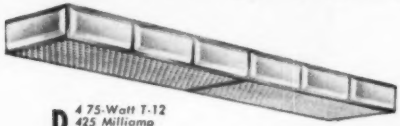
all eyes are on the *greatest*

Lighting Development since the fluorescent lamp



exclusive
MODULE plastic louver provides 40° transverse and longitudinal cutoff. Lamps are shielded at all normal viewing angles, yet light transmission is maximum.

these 4 low-cost modules are the "building blocks" of a perfect custom-fitting lighting installation...



D 4 75-Watt T-12 425 Milliamp Slimline Lamps

C 4 40-Watt T-12 48" Type F Lamps

B 32-Watt 12" Circline Lamp, and 1 PAR Spot or Flood Lamp

A 4 14-Watt T-12 15" Type F Lamps

modules fit together perfectly end to side, end to end, side to side... to form more than 50,000 different lighting patterns...to fit any ceiling shape or size...mixing all light sources in one harmonious system... with equal brightness throughout (no dark sides or ends)...so you can put the light where it is needed!

MITCHELL **module** REG. U. S. PAT. OFFICE

Only MITCHELL makes MODULE

custom fits any commercial interior— at no more than the cost of ordinary fixtures!

In just a few months, MITCHELL MODULE has won nation-wide approval and acceptance as an entirely new standard of commercial lighting. It is now being widely specified and installed in every type of commercial establishment—supported universally by lighting distributors, contractors, utility men and architects. The verdict of MODULE users is unanimous: "Here is complete lighting satisfaction!" Yes, here is the *first* and *only* lighting system that provides *all* the advantages of custom-fitted lighting at no more than the cost of ordinary fixtures...If you are not yet specifying MODULE, look into its superior possibilities—write for information today.

MITCHELL MANUFACTURING COMPANY
2525 N. Clybourn Ave., Chicago 14, Illinois

Send free 20-page brochure describing MODULE.

*Firm Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

*Attention:*_____

7½ Times more Brilliance! WITH 90% OF THE WATTAGE

That's how much a 900 W. Stonco Multi-Lite Assembly had over the conventional flood of an ordinary 1000 W. open reflector—according to tests made by a major oil company.*

What's more—Stonco fixtures cost approximately 30% less than ordinary reflectors. Also, a Stonco Unit is maintenance free. To the contractor these are the type of solid points that help him make a sale every time. For here is language anyone can understand—"More—for less".

*Name on Request

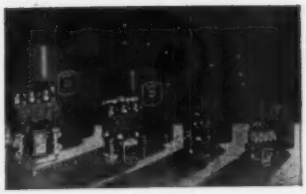
YOURS FREE—A complete chart of test readings comparing 1000 W. of conventional flood with 900 W. of Stonco Flood is now available for your study. It's a terrific sales story you can't afford to miss. Send for it today.

Typical 7 Unit Assembly

Typical 3 Unit Assembly

STONCO
Multi LIGHT SYSTEMS
STANDARD • LITEMASTER • FLOODMASTER
Sold exclusively thru Qualified Wholesalers • *Union Made*

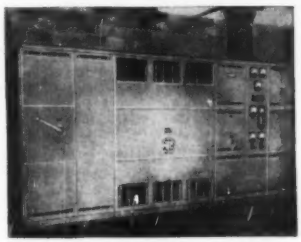
STONCO
STONE MANUFACTURING COMPANY
489 Henry Street Elizabeth 4, N. J.



Magnetic Starters (30)

A new line of a-c magnetic starters designed to conform to latest NEMA standards for industrial control has been announced. Standardized wiring and mounting dimensions have been adopted to simplify engineering, installation, and maintenance of machine controls. Size O, 1 and 2 open-type contactors and starters are made with standardized mounting dimensions. Holding circuit interlocks are located to the left of the vertical centerline, as specified by NEMA for Size 3 and smaller. NEMA standardized control and power wiring is furnished with all sizes of contactors and starters. Other design features on Size O up through Size 3 include straight-line guided motion of armature and movable contact assembly. Double break, silver-to-silver contacts are accessible for inspection and replacement without removing wiring.

Square D Company, Industrial Controller Division, 4041 North Richards St., Milwaukee 12, Wis.



Unit-Substation (31)

A new line of air cooled unit-sub stations has been announced. The complete power package consists of a dry type transformer, primary protection, as well as secondary breakers and metering equipment. The transformer section is constructed with Class B and C heatproof insulation. Absence of hazardous oil or toxic liquid makes this equipment ideal for installation in hospitals, schools, hotels, industry and any other place where safety is a factor. Available in sizes from 100 to 2000 kva. inclusive, both single and three phase, in voltages up to 15,000 volts.

Marcus Transformer Company, Inc., 32-34 Montgomery Street, Hillside 5, N. J.

Luminaires (32)

Announcement has been made of a series of incandescent luminaires for silver bowl lamps. This series includes the Seelux, in addition to the Seelux Plus, Skoolux and concealed indirects. They feature concentric louvres, both semi-indirect and indirect illumination. They have been planned for low maintenance and high efficiency.

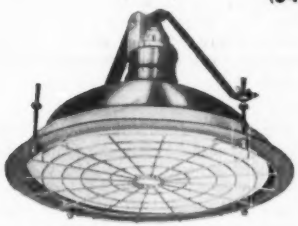
Edwin F. Guth Company, 2615 Washington Ave., St. Louis 3, Mo.

Motor (33)

A new Tri-Clad single-phase capacitor motor has been announced. To minimize overall dimensions, capacitors are mounted in the base of the motor, and there is no conduit box on the side. Conduit box has been replaced by a built-in terminal board inside the end shield. It has a totally enclosed built-in starting switch to keep foreign matter from the contacts and a new centrifugal mechanism. In ratings from ½ to 5 hp., these high torque motors are available in two types: Type KCS, capacitor-start and Type KCR, capacitor-run. KCS is designed for 115/230 volts and KCR is a single-voltage, 230 volt design.

General Electric Company, Schenectady, N. Y.

(34)

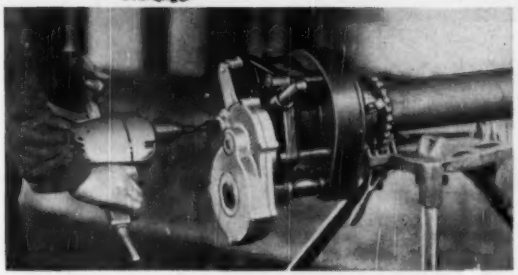


NEW GYMNASIUM LIGHTING UNITS ***are available. They have porcelain enameled reflectors, and are for flush ceiling mounting. Available for 300-500 watt and 750-1000-1500-watt lamps. Design permits installation and servicing from either above or below ceiling. Quadrangle Manufacturing Co., 32 So. Peoria St., Chicago, Ill.***

Transformers (35)

A line of machine-tool control transformers following the proposed standards of NEMA has been announced. They are particularly adapted to the inductive, low-power factor loads of solenoids, relays, and contactors making up machine tool control equipment. Seven sizes from 0.075 to 1.5 kva. are

SENSATIONAL INVENTION CUTS PIPE THREADING COSTS 70% OR MORE



PORTA-DRIVE REVERSIBLE POWER UNIT MAKES STANDARD DIES FULLY AUTOMATIC

The new PORTA-DRIVE, an inexpensive, portable, reversible power unit, makes possible a greatly improved pipe threading technique for many crafts and trades. Powered by electric or air drill, PORTA-DRIVE works faster, eliminates manual labor. A special, patented 20 to 1 gear ratio drive provides ample power for threading up to 8 inch pipe.

LIGHT IN WEIGHT — EASY TO HANDLE

Weighing only 14 lbs., the small, compact PORTA-DRIVE unit travels in an ordinary tool kit to provide shop power tool advantages out on the job. PORTA-DRIVE operates in horizontal, vertical, or any other position, and may be used with or without a vise. Allows threading in close quarters where ordinary threading methods will not work. PORTA-DRIVE is also reversible.

CUTS COSTS, SPEEDS WORK, MAKES PROFITS

PORTA-DRIVE is low in cost, often pays for itself on just one job. Recognized as a means of saving time and labor, it speeds work turn-over, increases profits.

Response to PORTA-DRIVE announcements has been nation wide. It is now obtainable from your jobber. See for yourself what PORTA-DRIVE can do! YOU are invited to arrange for a PORTA-DRIVE demonstration by your jobber without obligation, in your own place of business.

MUNCIE GEAR WORKS, INC.

Mail this coupon today Muncie, Indiana

Muncie Gear Works, Inc. — Dept. E 1
704 E. Wysor St.
Muncie, Indiana

Without any obligation on my part, please arrange for my free PORTA-DRIVE demonstration.

Name .....

Firm .....

Jobber's Name .....

City ..... State .....

SAVE HOURS ON

CONDUIT AND PIPE

INSTALLATIONS

...with a GREENLEE PIPE BENDER

Cut costs, speed your jobs this efficient, easy, economical way. Make "on the job" bends in pipe and rigid conduit up to 4½", thin-wall conduit and tubing with a GREENLEE Hydraulic Bender. One man operated for fast, accurate, uniform bending. Simple to operate, easy to set up and shift from job to job. Not only saves labor, but eliminates cost of many manufactured bends and fittings. Often pays for itself on first few jobs. Write today for free folder No. E-201.

TOOLS FOR CRAFTSMEN

GREENLEE

Other GREENLEE timesaving tools for industry: Hand Benders for Tubing • Hydraulic Pipe Pushers Knockout Tools • Auger Bits and Drills • Spiral Screw Drivers • Chisels and Gouges • And many others. Greenlee Tool Co., 1741 Columbia Ave., Rockford, Ill.

available for 220/440 volts primary to 110 volts secondary at 60 cycles. Transformers for 50-cycle operation are available in six sizes runing from 0.150 to 1.5 kva. for 208/220/380/416/440 volts primary to 110/95 volts secondary. Three sizes from 0.150 to 0.500 kva. are available for 25 cycle operation at 220/440/550 volts primary to 110 volts secondary.

Westinghouse Electric Corporation, Pittsburgh 30, Pa.

Utility Power Outlet (36)

Model P-50-WP utility power outlet has a 230 volt 50 ampere three wire receptacle. Also a 115 volt 15 ampere two wire twistite receptacle fused with a 15 ampere fusetat, mounted and equipped with solderless lugs for easy installation. Cabinet is galvanealed steel finished in gray enamel and has a 1 inch hub on the top and 1 inch and ¾ inch knockout in the bottom. It is also equipped with straps for installation on pole or wall. It can be installed outdoors or indoors wherever power up to 50 amperes is needed. Small receptacle is fused at 15 amperes for electric drills, grinders, drop cords or any other 110 volt tool. Large receptacle can be used for quick connection to electric welders, grinders, elevators or any other unit requiring 220 volt power.

Midwest Electric Products Company, Kankato, Minn.

Ballasts (37)

An improved line of 30 watt, 32-watt and 40-watt uncorrected-power-factor ballasts for fluorescent lamps has been announced. All of the basic components—core, clamps and case—of the new ballasts have been completely redesigned and retooled to reduce noise of operation to a minimum. Dimensions have been changed to permit use of ballasts with a wide variety of fluorescent lighting fixtures.

General Electric Company, Schenectady 5, N. Y.

Combination Bells (38)

Announcement has been made of a new development in the form of a combination vibrating and single stroke bell for a-c operation. Bells are shipped with a two-section plunger and a single section plunger. If a single-stroke bell is desired, a locking screw is loosened, the bell shell lifted and the single-section plunger is dropped in the solenoid coil; if a vibrating bell is desired, the two-section plunger is inserted in the coil. The change from either vibrating or single-stroke styles may be made within seconds. There are no contacts to adjust. They are available in 4, 6, 8, 10 and 12 inch sizes, and may be finished in red or black as required. Terminal block is of porcelain. Knockouts are provided in top, bottom, back and sides for ½ inch conduit.

Autocall Company, Shelby, Ohio

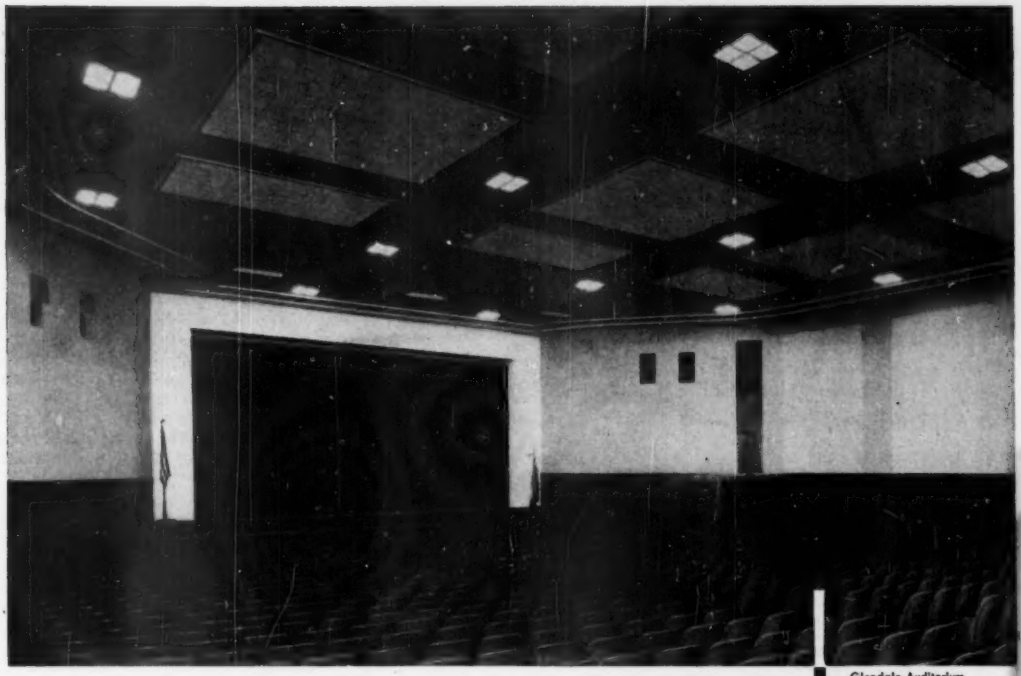
Product Briefs

(39) Electrical Manufacturing Co., Battle Creek, Mich., has developed a service mast to secure necessary clearance above ground for the service wires on ranch type and low roofed houses. . . . (40) A new circuit breaker type combination starter, designed for control of polyphase motors has been announced by Square D Company, Milwaukee, Wis. . . . (41) Atomic Instrument Co., Boston, Mass. has announced a packaged electrical reset register for use with all types of nuclear and industrial equipment.

(42) A new line of suspension and strain clamps, designed for use on A. C. S. R. and all-aluminum conductors, has been introduced by Brewer-Tichener Corp., Cortland, N. Y. , , , , (43) Potter Instrument Company, Flushing, N. Y. has developed two high speed photoelectronic count detectors. . . . (44) Koldweld Corporation, New York City, has introduced cold pressure welding, which can be applied to several types of non-ferrous metal.

(45) The International Rectifier Corporation of Los Angeles, Calif., has developed a new line of high voltage selenium miniature rectifiers for electronic applications requiring the conversion of a-c to d-c. . . . (46) Transformers for use as a source of high voltage in equipment for electrostatic precipitation of smoke, metals, or other materials from gaseous mixtures are available from Westinghouse Electric Corp., Pittsburgh, Pa. . . . (47) Mitchell Industries, Inc., of Mineral Wells, Texas, has announced a new 6-inch electric soldering iron known as Vasco "Petite".

(48) By the substitution of a new halo phosphate phosphor on the inside coating of fluorescent lamps, Solar Electric Corp., Warren, Pa., has eliminated the toxic beryllium phosphors and increased the light output of the lamp. . . . (49) Perry Manufacturing Company, Minneapolis, Minn., has announced a new draw-thru punch set for cutting holes in sheet metal areas.



Glendale Auditorium, Glendale College, Calif.
Architect: George Lindsay, Glendale
Fixture Manufacturer: C. W. Cole & Co., Inc., Los Angeles
Electrical Contractor: Victory Engineering & Electric Co., Los Angeles
Glass: PYREX brand Lenslites

For Prismatic Control of Incandescent Light Sources . . . Recommend Fixtures with PYREX Brand Lenslites

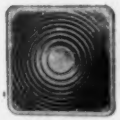
When light control is a problem, ask for fixtures equipped with PYREX brand Lenslites or CORNING brand Lens Panels. The above illustration for example, involved the problem of illuminating an auditorium to an intensity great enough for study purposes but at the same time subject to dimmer control for dramatic productions. The room is 82 feet wide by 85 feet long. Average ceiling height is 24½ feet. Using 300 watt lamps, the average reading is 23½ foot candles, an efficient lighting job.

PYREX brand Lenslites are designed for concentrating, spreading or beam offsetting light from incandescent sources. Available in round or square types in many sizes.

CORNING brand Lens Panels for control of fluorescent light sources are basically Fresnel lenses in cross section with prisms running parallel with the light source. They are made of high quality crystal glass in a number of sizes and focal lengths to meet almost any requirement—concentration, spread or offset beam.

Corning lightingware is sold through all leading fixture manufacturers, many of whom feature fixtures with CORNING ALBA-LITE, FOTA-LITE, Lens Panels and Lenslites.

Round Pyrex brand Lenslites —6½", 8⅝", 11¼", 13¾" diameter—all wide angle.



Square Pyrex brand Lenslites —6½" conc., 8" conc., 8" wide angle, 12" conc., 12" wide angle.

FOR EFFICIENT, ATTRACTIVE LIGHTING...

CORNING ALBA-LITE for diffusion of fluorescent light

CORNING FOTA-LITE for high level illumination

PYREX brand LENSLITES and CORNING brand LENS PANELS for prismatic light control

CORNING GLASS WORKS **CORNING, N. Y.**

Corning means research in Glass

"Know-How"

means profits for electrical contractors, especially when they know how fast and easily they can cut and drill thru concrete and masonry with dependable—

SYNTRON

ELECTRIC HAMMERS

These dynamic little "earners" actually pay for themselves at the job-tried rate of $4.00 every hour.

Producing 3600 hard blows per minute, Syntron Hammers are built to "take it" on job after job. 50,000 in use have proven this.

They are available in five different models—all small in size yet big in power.

Write for Literature

SYNTRON CO.

690 Lexington Ave. Homer City, Pa.

. . . (50) International Instruments, Inc., New Haven, Conn., has in production a new 1½ inch diameter panel meter with interchangeable face plates.

(51) A new capacitor switch, rated 15,000 volts, 100 amperes continuous, 3-phase, has been announced by General Electric Co., Schenectady, N. Y. . . . (52) J. H. Williams & Co., Buffalo, N. Y., has a new stud remover, No. S-60-B, designed for use with ½ inch square drive handles and attachments. . . . (53) A new smoke density indicator has been developed by Photoswitch Incorporated, Cambridge, Mass.

(54) The magnetic tube hammer is designed for those difficult-to-get-at nailing jobs. It is manufactured by Tube Hammer Mfg. Co., Pasadena, Calif. . . . (55) Industrial Devices, Inc., Edgewater, N. J., has developed a new general-purpose volt-ampere tester that plugs in between line and connection cord and provides simultaneous voltage and amperage readings directly off two dials. . . . (56) Combustion Control Corporation, Cambridge, Mass., has introduced a new control designed to provide automatic starting and programming for commercial and industrial oil and gas burning equipment.

(57) Cornell-Dublier Electric Corp., Indianapolis, Ind., has announced a new line of vibrator converters, designed specifically for railroad communications and power conversion requirements. . . . (58) Sudenga Iron Works, George, Iowa, has developed a portable drill press designed for use with any ¼ inch to ½ inch electric drill. . . . (59) Flexilab Products Company, Denver, Colo., has added a new No. 721 insulated jack to its line of electrical terminals and adapters for laboratory work.

(60) Barcol type Cyak shaded 4 pole motor has been redesigned to improve its performance and increase its versatility by Barber-Colman Company, Rockford, Ill. . . . (61) An improved oven-temperature tester, redesigned for portability and ease of operation, has been announced by General Electric Co., Schenectady, N. Y.

(62) A new ⅛ inch solenoid valve for industrial use has been announced by Ross Operating Valve Company, Detroit, Mich. . . . (63) George Ulanet Company, Newark, N. J., has announced the addition of a new miniature thermostat for pilot control applications to its line. . . . (64) Insulation Manufacturers Corporation, Chicago, Ill., has introduced a new Inmanco brand of formed fibre wedges.

(65) A new pistol-grip slip joint combination plier has been developed by Utica Drop Forge & Tool Corp., Utica, N. Y. . . . (66) An explosion-proof electric radiator has been developed by Burnham Corporation, Irvington, N. Y., for use in Class I—Group D atmospheres. . . . (67) A new plastic armored metal tubing having high corrosion resistant properties and designed for use as electrical conduit or for transmission of water, air or gas has been announced by Samuel Moore & Company, Mantua, Ohio.

(68) A new clutch coupling with taper bushings designed to accommodate any shaft from ¾ inch to 1¾ inch diameter with standard keys has been announced by Centric Clutch Company, Cranford, N. J. . . . (69) Tyler Manufacturing Co., Los Angeles, Calif., has available a band saw featuring spiral shaped blade in two improved models.

(70) International Register Co., Chicago, Ill., has announced production of a new series of self-starting, synchronous timing motors. . . . (71) Cuffed paper insulation in dispenser package has been introduced by insulation Manufacturers Corporation, Chicago. . . . (72) Syntron Company, Homer City, Pa., has added a new model of electric hammer, with a ¼ inch diameter drilling capacity to its line of portable electromagnetic hammers.

(73) A new light-weight ground power supply suitable for medium requirements of low-voltage d-c power for aircraft, airports, and aircraft testing stations has been announced by General Electric Co., Schenectady, N. Y. . . . (74) A fluid tractor for propelling electric or hand hoists on monorails and cranes has been announced by Calabar Corp., South Gate, Calif. . . . (75) Aget-Detroit Company, Ann Arbor, Mich., has announced a new filterless dust collector.

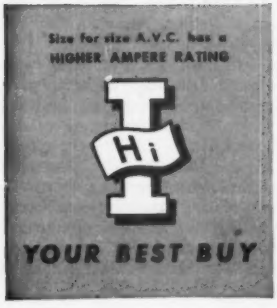
(76) A redesigned sound probe now electronically controlled has been announced by Como-Tex Company, Chicago, Ill. . . . (77) Templeton, Kenly & Company, Chicago, has introduced a new steamboat ratchet pulling jack of 20 tons capacity for use in the marine, construction and engineering fields. . . . (78) Germatrol, a glycol vaporizing unit, is especially designed for use in public building and private homes.

(79) Shock and short proof attachment plug cap, wall plates and duplex convenience outlets have been announced by Philise Switch & Manufacturing Co., Inc., Davis, Calif.

ROCKBESTOS A.V.C.® CARRIES 32% GREATER LOAD

YET BOTH ARE THE SAME SIZE

Compare A.V.C. with Type RH in a 250 MCM size*



- you use 2½" conduit for both
- you use the same size fittings and lugs
- you have the same installation costs
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*From Chapter X—National Electrical Code—3 conductors in conduit—40°C-104°F.

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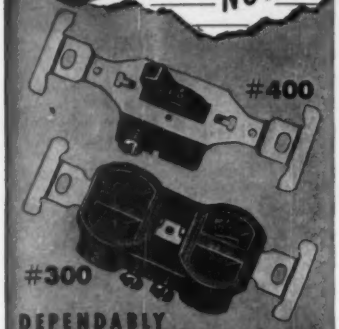

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(80) ELECTRICAL CONNECTORS for industrial wiring are presented in 80-page catalog No. 52 with text, photographs, charts, tables and diagrams. Burndy Engineering Co., Inc.

(81) FARM LIGHTING equipment, including yardlights, low voltage remote control systems and heat reflectors are discussed in bulletin 122-50. Steber Manufacturing Co.

(82) INTERCOMMUNICATION, with the new Executone featuring electronic voice circuits and chime-light signalling, is subject of form 290. Executone, Inc.

(83) RECLOSERS for five coil sizes are explained with diagrams, semi-pictorial drawings, specifications and mounting details in bulletin B4339. Westinghouse Electric Corp.

(84) LOW HEAT WELDING information, such as 65 rods and electrodes for torch and arc welding, is presented with selection chart in 1950 Directory. Eutectic Welding Alloys Corp.

(85) TAPERED SLEEVE SPLICE, developed for greater flexibility and compactness in connection with sling loops, is discussed in file folder. John A. Roebling's Sons Co.

(86) TUBECHECKERS can be modernized to include latest calibration data when converted in accordance with instructions compiled by Weston Electrical Instrument Corp.

(87) MINIATURE LAMPS for residential use are presented in leaflet 3-9280, titled "The Light Touch". General Electric Co.

(88) UTILITY TRUCK BODY, for carrying tools, materials and construction equipment, equipped with racks, bins, chain hooks and special brackets, is subject of form H75-5M8-49. York-Hoover Corp.

(89) MATERIALS HANDLING manual, showing 355 ways to cut inventories, has been prepared by Aerol Co., Inc.

(90) WATTHOUR METER of improved design is described and analysed in catalog 4425 by Roller-Smith.

(91) RECTIFIERS are discussed as to application, construction, regulation, operational cost, maintenance and use in bulletin 200. Accurate Eng. Co.

(92) CIRCULATORS, fans and exhaust equipment are specified, pictured and priced in 8-page 2-color folder. Frigid Circulators & Devices Mfg. Corp.

(93) MAINTENANCE EQUIPMENT catalog 28 contains details on rotary burs and files, undercutters and saws, scrapers and bench growlers, instruments and tools. Martindale Electric Co.

(94) SECTIONAL SCAFFOLDING, portable elevators, material hoists and suspended platforms are discussed from the points of flexibility, durability, economy and safety in file folders prepared by Wilson-Albrecht Co., Inc.

(95) INCANDESCENT lighting fixtures for commercial and institutional use are sketched and specified in folio I-49. Gruber Brothers, Inc.

(96) GRAPHIC INSTRUMENTS to record the running histories of industrial operations are discussed in Case 38, "Solving Industrial Crimes". The Esterline-Angus Co., Inc.

(97) DISTRIBUTION TRANSFORMERS in sizes 37.5 to 100 kva are pictured and discussed in catalog 1049. Pennsylvania Transformer Co.

(98) INSTRUCTIONS, manual 6800, includes specifications of Start-O-Metic Analyser with typical testing operations for checking continuity of motor windings, location of grounds, operation of capacity-start motors and miscellaneous testing. Airserco Manufacturing Co., Inc.

(99) STEEL shelving, lockers, parts trucks, bins and files are pictured and priced in 12-page catalog. Precision Equipment Co.

(100) CO-ORDINATED CLASSROOMS, including seating arrangements, work location, lighting, health of students and architectural design, are analysed in AIA file 35B. F. W. Wakefield Brass Co.

(101) ELECTRIC HEAT applications are discussed and diagrammed in 26-page 2-color booklet titled "100 Ways to Apply Electric Heat". Edwin L. Wiegand Co.

(102) ELECTRICAL TAPE number 27 with thermoplastic adhesive and glass cloth backing, recommended for locations subjected to high temperatures, is discussed in file folder prepared by Minnesota Mining and Mfg. Co.

(103) BLOWERS AND EXHAUSTERS in 12 sizes with capacities to 5500 cfm are specified and dimensioned in bulletin 3014D-5M-10-49. Buffalo Forge Co.

(104) ROOM HEATERS, built in and portable models, as well as unit heaters for industrial and commercial applications, are discussed with pictures, wiring diagrams, specifications and prices in two file presentations released by the Electromode Corp.

(105) ELECTRICAL EQUIPMENT for shop, farm and home, including welders, heating cable, soldering irons, battery chargers, floodlights, motors, control and heating equipment, is presented in GEC 483-1 dealer catalog by the General Electric Company.

(106) LIGHT DIMMING EQUIPMENT for schools is subject of form 9491. The Superior Electric Co.

(107) STOCK HANDLING EQUIPMENT, storage, materials handling and small parts assembly equipment, such as steel bins, boxes, tables, shelving and lockers, is presented in catalog 110 by Red Tiger Products, Inc.

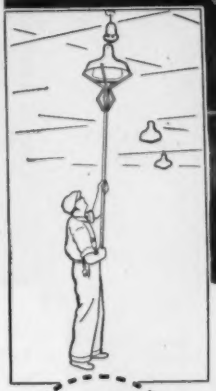
(108) MERCURY SWITCHES for industrial applications, with mercury-to-electrode and mercury-to-mercury contacts, are discussed in catalog 1343. Minneapolis Honeywell.

(109) CONNECTORS, pictured in color and described with the aid of charts, tables, specifications and dimensions are presented in 70-page manual. Ilsco Electrical Connectors.

(110) GLASS FIXTURES for residential lighting applications are presented in color in file folder prepared by Brassner Products, Inc.

(111) CAPACITOR MOTOR, Tri-Clad single-phase model, is described with diagrams, pictures, tables and text in GEA 5401. General Electric Co.

(112) MEGOHMMETER with range from 300,000 to 20 million megohms is discussed in file folder 1029. Herman H. Sticht Co., Inc.



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Catalog Number	Poles or Wires	Blades or Contacts	Plug Fuses	Neutral
*632NP	2	1	1	Solid
*632P	2	2	2	None
*633NP	3	2	2	Solid

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Reader's Quiz

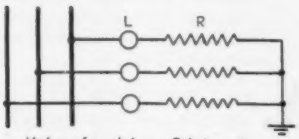
Ground Indication

QUESTION 334—Could someone suggest what to do in order that a grounded phase would register by means of a light or signal placed at our various substations?

Our power supply is 440 volts, 3 phase and the transformers are connected delta with no ground connection.

Each substation has from four to six feeders, but it would not be necessary to indicate on which feeder the ground has occurred. —F. F.

A. TO QUESTION 334—There are several methods that F. F. could use to give a ground indication on his 440 volt three phase delta system. Perhaps the simplest would be to connect three lamps as shown in the accompanying sketch.

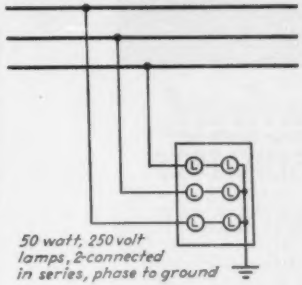


Value of resistance R is based on wattage of lamp L

The normal voltage to ground from any phase is about 250 volts. F. F. should use a resistance in series with each lamp that will permit the lamp to burn at about half brilliancy at this voltage. A ground on any phase will darken the lamp on the grounded phase and the other two lights will then burn at increased brilliancy. If it is desired, a voltmeter or relay could be substituted for the lamp. The intensity of the ground will be shown by the brilliancy of the lamp on the grounded phase—a solid ground putting the lamp out completely.—W. P. R.

A. TO QUESTION 334—We use several ground detectors that we have made up by mounting six standard sign receptacles on the hinged door of 8 inch by 12 inch by 4 inch deep standard surfaced steel cabinet boxes. We use 50 watt, 250 volt standard service lamps. In some cases, we have several of these detectors on one transformer bank located at various load centers. In case of ground occurring on motor circuit and watching the lamps when motors are started or stopped, we can readily determine the circuit which is grounded. Lamps will "go out" or dim on the grounded phase depending on resistance of ground.

Delta connected ungrounded 440 - 3 phase, 60 cycle circuit



50 watt, 250 volt lamps, 2-connected in series, phase to ground

The above sketch shows connections used.—J. W. B.

A. TO QUESTION 334—On each substation, an indicating light or signal can be purchased from your local dealer that is connected from a feeder to ground. These indicating lights will burn when lines are clear. In event of any phase grounding, the light goes out on grounded phase and burns with more brilliancy on the other two phases.—E. S. H.

Current For Starting Motor

QUESTION 335—What could be the cause for blowing 35 amp. fuses (fusetrons) on a 7½ hp. motor operating a blower on an automatic boiler? All equipment is new.

During the week, with the plant in operation and voltage at 220, the fuses will not blow.

However, on weekends, with plant idle and voltage at approximately 250, the fuses will blow. —D. A. C.

A. TO QUESTION 335—The reason your 35 amp. fusetrons will allow your motor to start at 200 volts, but not at 250 volts, is simply that at 250 volts your motor has a larger starting current.

The starting current of an induction motor is directly proportioned to the applied voltage. So at 250 volts, the starting current is 250/200 or 125% of what it is at your normal operating voltage of 200.

Obviously, the 35 amp. fusetron, in spite of its inherent time lag characteristic, is not large enough to handle the starting current your motor draws at 250 volts.—L. M. B.

A. TO QUESTION 335—Assuming that the motor referred to by D.A.C. is rated at 7.5 hp.-200 volts, the full load current at 200 volts is given as approximately 25 amperes if it is a three phase motor. The inductive reactance at full load and full speed would be about 8 ohms. This reactance remains a constant if the cycles and speed remain constant. The application of 250 volts cannot appreciably increase the speed so that the current would then rise to about 31 amperes. But if the motor is slightly overloaded, the slip will be decreased by the additional voltage and the current will go well beyond 35 amperes. —W. B. M.

A. TO QUESTION 335—As no nameplate data is furnished, other than horsepower and voltage, we will assume that if it be a d-c motor and, for fan duty it should be a shunt wound motor. Then by Ohm's Law, not knowing the motor eff. etc., at 200 volts, 7½ hp., the wattage is $7.5 \times 746 = 5595$ watts, the current is $5595 \div 200 = 27.975$ amps., the total resistance is $200 \div 27.975 = 7.149$ ohms. When the voltage is raised to 250, the rated horsepower and resistance remain constant, while the current has risen to $250 \div 7.149 = 34.97$ amps. As the resistance must remain constant due to no change of the winding (which is an insufficient number of ampere-turns across this higher voltage and causes abnormal heating) and, as the fan duty is constant, the fusetron will blow by thermal action. If the motor be an a-c induction motor, the increased voltage should be accompanied by a like increase in frequency to cause the electrical and magnetic

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conditions to remain normal. This added heating due to current increase and the wrong number of turns per phase group of the stator will also call for thermal action due to constant duty.—J. V. H.

A. TO QUESTION 335—The source of trouble in this case is high voltage. The 35 amp. fusetrons holding the starting current easily at the 200 volts are blown by a much increased starting current at 250 volts. This is based upon the simple fact that the starting current taken by an induction motor depends upon the voltage impressed on the stator and the resistance of the rotor circuit. For a fixed rotor resistance, the starting current varies directly with the impressed voltage. In this case, the impressed voltage increases 25%, as the resistance of the rotor circuit remains constant, the starting current increases 25%, the result being "blown fuses.—L. R. D.

Cable Buried in Concrete

QUESTION 336—I would like to know if any of your readers have any experience regarding the relative life of various cables buried directly in concrete? I am interested in using RW, TW, rubber with lead sheath, and this latter type with the addition of an overall braid.—C. S.

A. TO QUESTION 336—We are and have been using type RW cables for 20 years in our underground distributing system covering many miles of city streets, and its operating record has been well nigh excellent. It should not, however, be used where it would be exposed to concentrations of oil.—J. M. T.

A. TO QUESTION 336—The method of installation you mention is not a very common one, and I am not sure that it would pass the local inspector. I would suggest taking it up with him before making an installation.

Some twenty-five years ago I installed some BXL underground without even the protection of concrete, across a garden. It is still there and so far has given no trouble.

Either RW or TW lead covered with a protective braid should be used. The problem would be to prevent injury while pouring the concrete. Once installed without injury, it should last a long time providing there were no acids and moisture present in the concrete to corrode the lead. If, how-

ever, it should ever give out, you would have some difficulty in replacing it.—A. E. T.

A. TO QUESTION 336—All of the systems are giving poor results when we try to use them in the same manner as reinforced steel in concrete, due to unequal expansion. We must buy our merchandise, both electrical and concrete, as it comes, and in order that you should not be left with an open circuit or short circuit after the concrete is poured, I would recommend raceways for the wires made in the cement with a sponge rubber hose which is removed after the cement hardens, or metal raceways without kinks. Type TW is good enough for any job because it behaves nicely in moist places, is not affected by most chemicals or by high temperatures which affect rubber. This does not mean that you can place type TW or any type R wire next to a hot steam or water pipe, or next to a different hot item.—H. S.

Magnetic Poles

QUESTION 337—Please advise us on the following practice. After removing the pole pieces from a d-c generator or motor for purposes of repair and overhaul, we do not paint the bottoms of the poles, or those sections on the stator frame where the poles are secured. A minority of the men in our shop believe that no harmful change in characteristics will result from painting between the poles and frame. Others are firmly against the practice.—A.H.J.

A. TO QUESTION 337—In replacing pole pieces on a d-c generator or motor, the pole pieces and that part of the frame coming in contact with the pole piece must not be painted, as it is very important that they should fit tight to the frame to prevent unnecessary air gaps and reluctance in the magnetic circuit. Magnetic reluctance must be kept as low as possible and paint or any foreign substance between the pole pieces and frame would tend to interfere with the flow of magnetic lines of force between the poles through the frame.—M. H. S.

A. TO QUESTION 337—Neither the surface of the pole pieces or that of the stator frame where they make contact should be painted.

Both surfaces should be free of all grease, paint or rust and thoroughly cleaned so as to make as good a contact as possible.

Any paint or non-magnetic sub-

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RELIANCE TIME SWITCHES

stance between these surfaces will hold them apart causing an "air gap" which will increase the reluctance of the magnetic circuit and reduce the strength of the field, resulting in slightly higher speed with reduced torque in a motor or lower voltage in a generator necessitating increasing the field current; result, lower efficiency and more heating.—A. E. T.

A. TO QUESTION 337—The bottoms of pole pieces and the sections of the motor frame to which they are fastened should positively not be painted. The surfaces to which these pole pieces are held should be smoothly machined to insure a perfect fit, making the metal to metal contact as nearly perfect as possible. In fact, when pole pieces are removed, they should be marked with a center punch on one end with corresponding marks on the frame. This procedure will enable the pieces to not only be replaced in the same location, but also prevents them from being turned end for end. All these precautions are taken to eliminate as much reluctance as possible from the magnetic circuit. The stator frame is as much a part of this circuit as the poles and the armature. Any space between the pole pieces and the frame created by a non-magnetic substance adds greatly to the reluctance, actually reducing the number of magnetic lines of force, thereby weakening the field strength of that particular pole. This will not only weaken the field strength of the machine, but may also cause an unbalanced magnetic condition due to some poles having more strength than the others. Incidentally, if it becomes necessary to shim a pole piece, the shim must be made from a metal of good magnetic qualities.—H. C. S.

A. TO QUESTION 337—Painting the ends of generator field poles will increase the reluctance, or magnetic resistance, of the field magnetic circuit. This, in turn, would require more field current to produce the same generator output, and the power (I^2R) loss in the field would be greater. How much greater would depend upon the generator involved.

Materials like iron and steel have very low reluctance when not saturated, while non-magnetic substances like air, paint or fiber have a fairly high reluctance. If the generator were fairly large, and the layer of paint were thin, there might be no evident change in the characteristics; on a smaller generator, with a thick coat of paint, an obvious increase in field current might result. Except for this, there would be no changes in the generator.

If painting the ends would result in labor savings during the recondi-

tioning of the generators, this savings might offset the slightly increased field loss. In general, however, very little would be gained by painting this portion.—D. H. N.

A. TO QUESTION 337— I do not believe that it will make any difference, electrically, one way or the other, if the pole pieces or frame or any other part of the magnetic circuit is painted or not, so long as there is no mechanical friction between moving parts.

In the first place, the permeability of paint and air is for practical purposes, the same. And the air gap is determined at the time of designing. The slight spacing between pole pieces and core of field due to thickness of paint, will cause an equal decrease in air gap between pole piece and armature, but the length of the magnetic circuit will not be changed, the net results remaining the same.—R. F. T.

Can you ANSWER these QUESTIONS

QUESTION A16—We have a 230 volt, 1½ hp. Westinghouse motor on a refrigeration compressor that heats the governor spring on the throw-out fingers until they break. Why? The motor is not overloaded, and runs cool at all times, and is protected by a thermal guard.—D. S.

QUESTION B16—Perhaps some of the readers could tell me why the pigtails come out of the brushes and the brushes get so fast in the holder that the spring has no action on the brush. This is on a generator d-c driven by an a-c induction motor. This is a reconditioned M-G set.—A. F. L.

QUESTION C16—We have a Crocker Wheeler 75 hp. d-c motor driving a coal pulverizer. This motor draws 200 amps and is rated at 265 amps.

We have constantly experienced some commutation trouble. We use factory made reaction brushes. We have also had this motor in the best motor repair shop in this area to be checked.

Now, nine months after the last check-up, some of the commutator bars are again black, while adjacent bars are bright.

Is it possible to correct this trouble, or would the hardness and softness of the different commutator bars cause this trouble?—L. A. H.

PLEASE SEND IN YOUR ANSWER BY FEBRUARY 15

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Easy to install Wall or floor mounting. No extra brackets needed.

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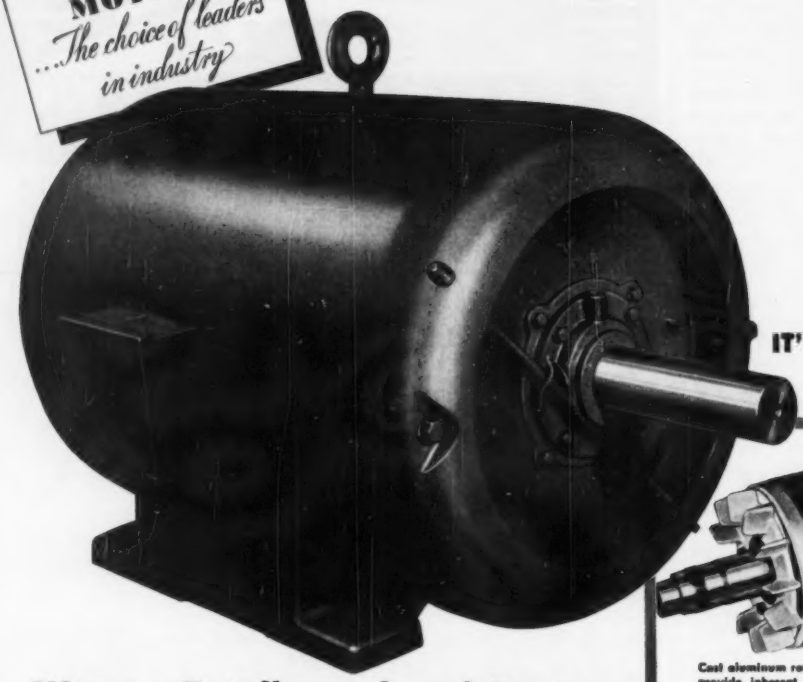

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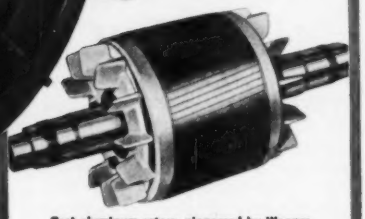
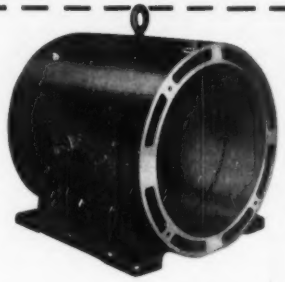


Cast aluminum rotors, pioneered by Wagner, provide inherent mechanical and electrical characteristics that add quality and dependability to Wagner type CP Motors.



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GLENN ROWELL
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

Questions on the Code

Standby Plant

Q. *When a standby generating plant is installed and connected through a double throw switch, should the distribution service drop or the standby plant be attached to the top terminals of the switch?*—E.L.L.

A. It makes no difference, either could be fastened to the top terminals. However, if a double throw switch is mounted in a vertical manner, some type of locking device must be provided which will hold the blades in the open position. This requirement will be found under Section 3806. In this section you will also find permission to mount such switches in a horizontal manner and when so mounted no locking device is needed. Therefore you will find it common practice to mount them in a horizontal position. Many R.E.A. projects now require that the neutral be switched and forbid the former practice of tying all neutrals together. This is done to assure there being no unbalance of load currents on the distribution line while it is disconnected for repairs.—G.R.

Dust-Tight Fixtures

Q. *We are hanging some new dust-tight fixtures in a feed mill. The conduit system is all in place and it has ordinary condulets that are not dust tight. We have found a swivel type cover that will fit these condulets and want to support the new fixtures on five foot conduit stems. Now must these conduit stems be sealed off between the swivel and the fixture?*—E.M.C.

A. The Code under Section 5505 will require the conduit to be sealed unless the fixture itself contains a seal. Many Class 2 Group G fixtures are provided with such a seal, so if the ones you are hanging do not contain a seal, you will have to seal off the conduit stem or the fixture to prevent dust from entering. This seal need not be of the type required in a Class 1 location as any effective closure that will stop the movement of dust is all that is required. This might be a soft composition plug pushed in about the conductors in the stem or any sealing compound. Section 5050 reads as follows: "Where a raceway provides communication between a nondust-tight fitting or enclosure and one which is required to be dust-tight, suitable means shall be provided to prevent the entrance of dust into the dust-tight enclosure through the raceway. This means may be (1) a permanent and effective seal; (2) a horizontal section not less than 10 feet long in the raceway; or (3) a vertical section of raceway not less than 5 feet long and extending downward from the dust-tight enclosure." You will note the third method cannot apply to fixtures as the vertical section extending downward to a dust-tight fixture is not included.—G.R.

Throw Over From Utility to Private Plant

Q. *A farmer has a 110 volt a-c plant but the farm is now wired for utility service and he wants a manual throw-over switch so that he can switch the lighting load on to his plant in case of utility service failure, if this is permissible. Could this be done at the yard pole with a weatherproof cabinet or would it have to be in a building?*—E.N.D.

A. Assuming that the utility supply is two wire 110 volt with one conductor grounded, a double throw switch could be used to transfer the load from the Utility supply to the private plant. Of course one conductor of the private plant would have to be grounded at the generator as well as at the service switch.

This double throw switch could be on the pole and could serve as the service switch if housed in an appropriate cabinet and if of the externally operable type to satisfy the requirements of a service switch.—F.N.M.S.

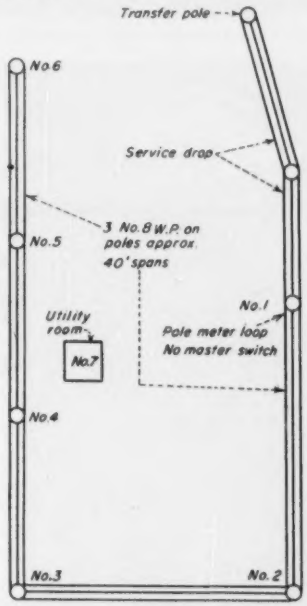
Feeder vs. Circuit

Q. *We have several trailer camps and cabin camps now in use and more under construction; and a difference of opinion has arisen as to the necessity of a master switch at the meter pole, from which the trailer stations are served.*

The utility company and I insist that Section 2351 of the Code would cover installations of this kind, the same as an apartment building with more than six breakers.

The electricians installing the job, claim that the breakers and fused switches at each station would take care of the job O.K., as they insist the open wiring on the poles, from the meter to the breaker stations, is secondary.

It seems to me that the secondary would stop at the meter-loop head, as usual, and any additional wiring would be circuits to points of service. I would appreciate your opinion on this.—W.B.B.



A. It would seem to this writer that there should be a main or master switch at the meter at least for safety's sake regardless of whether the Code calls for such a switch or not, then the incoming wires from the transformer pole to this service switch

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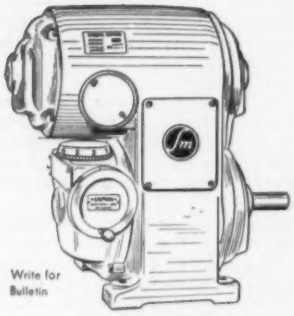

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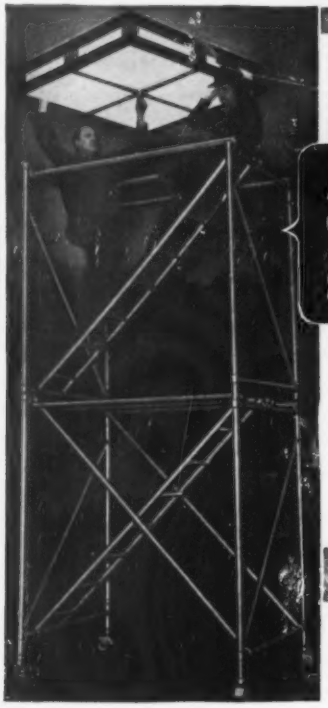

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could be regarded as service wires, while the other wires from the service switch to the other switches or circuit breakers, could be regarded as feeders (in the question called "Secondaries").

It might be argued that service wires could be run all the way around the installation on the poles and that up to six fused switches or circuit breakers could be placed on each pole to serve as service switches for the branch circuits leading to the connections for the trailers. However, it would be much safer to have one main service switch which could be disconnected in case of emergency.—F.N.M.S.

Conductors

Q. *May a Type SE three conductor cable containing an uninsulated conductor be used for any inside wiring in addition to its use as a circuit cable for a range or water heater?*—M.A.V.

A. In any building in which a non-metallic wiring system may be used an approved Type SE cable containing an uninsulated conductor may be used for any kind of a circuit provided the uninsulated conductor is used only as a grounding conductor and not as a neutral conductor and the voltages involved do not exceed 150 volts to ground.—G.R.

Service Equipment

Q. *A number of new homes are being erected here and if possible I would like to put the service equipment in the garage building on the alley line of each lot and run the feeder to the house underground. The garages are hipped roof structures using eight foot studs, so if I must provide ten foot clearance at the garage I will have to add a post or upright to the building, which will not enhance its appearance. As the distribution line extends down each alley, can I use service drop cable from the pole line to a service head just as close to the eave of the garage as I can place them?*—P.M.S.

A. You need not use a mast or pole for the support of the service head on the garage buildings provided the distribution line is so located you can maintain an 18-foot clearance over the alley. You will find such permission under Section 2324. However, in this new residential section, would it not be better to keep all conductors underground and bring your service down the pole in conduit to a junction

box from which you can feed three or four homes on each side of the alley.

It will be permissible to place the meter and a disconnect switch in the garage if you wish, but you must also have a regular service within the dwelling. Section 2302 provides permission to supply one building through another when both buildings are under single management or occupancy.—G.R.

Conduit Fill

Q. *Would it be wrong to use 6 No. 12 Ampyrol insulated wires in ¾ inch conduit?*—W.P.

A. Table 4 of Chapter 10 of the Code governs the number of wires permitted in the various sizes of conduits. The sizes given in Table 4 are to be used for all of the ordinary installations such as Types R-32, R, RH, RW, RU, TF, T, TW, also Type V, but not for the lead covered wires, Types RL & RHL, nor for the asbestos-varnished-cambric insulated wires such as AVA, AVB and AVL. These latter have to be computed in accordance with the cross-sectional square inch area and the proper percentage of conduit fill.

Table 4 purposely allows for a slight future expansion of carrying capacity.

Table 4 shows that 1 inch conduit has to be used for 6 No. 12 wires and this restriction covers Types T and TW wire.

"Ampyrol" is the manufacturer's trade name for its Type TW wire and more than 6 of these wires cannot be used in one inch conduit except "for rewiring existing raceways for increased load where it is impracticable to increase the size of the raceway due to structural conditions in which case 50% raceway fill may be used. See Table 11.—F.N.M.S.

Wires in Same Conduit

Q. *We would like to see a discussion of the last sentence of Paragraph 3011, N.E.C., with regard to remotely controlled (by pushbutton) motors in Class 1, hazardous locations.*

Our standard practice is to run the control circuit, consisting of 3 No. 12 conductors, in a ¾ in. conduit from the motor starter to the pushbutton station located by the motor controller, with the motor branch conductors in a separate conduit.

Now, on small motors in the 10–12 hp. range, it would be economical to run the motor branch and control conductors in the same conduit, a method which appears sanctioned by Paragraph 3011. Yet, many persons in the petroleum industry have vehemently

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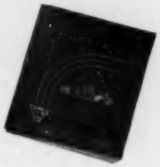

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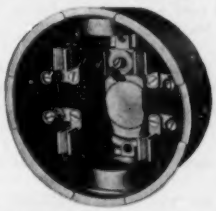

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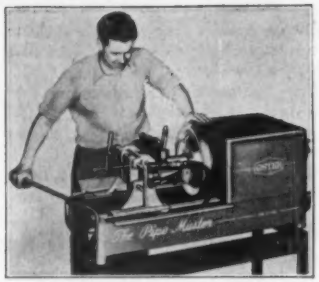

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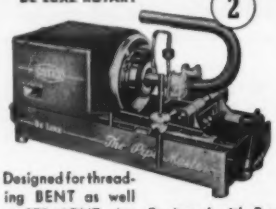

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argued that such is a code violation, citing the N.E.C. and a "Refinery Code", which we have not seen.

In short, is there any reason for not running motor branch and control conductors in the same conduit, provided Paragraph 4372 is adhered to?—E.H.E.

A. The fact that this installation is in a Class 1 hazardous location, does not alter the installation rules regarding the inclusion of control circuit wires in the same enclosure or conduit with the motor branch circuit conductors.

The last sentence of Section 3011 of the Code specifically permits the control or relay wires of a motor or starter to be installed within the same conduit, or other enclosure, as the motor circuit conductors.

Of course Section 4372 has to be complied with in order to assure proper protection for such circuits.

This writer has not seen nor heard of a "Refinery Code".—F.N.M.S.

Electrical Equipment For Hospitals

Q. *We have a hospital job coming up and the equipment salesman has told me that ordinary electrical equipment can now be used in a hospital operating room when it is located five feet or more above the floor. If this is true, will it be O.K. if I mount ordinary outlets and tumbler switches five and a half feet above the floor?*—R.A.

A. The N. E. Code, in a fine print note following Section 5004, states that for protection against the hazards of flammable anesthetics the standards for Hospital Operating Rooms as published by the National Fire Protection Association should be followed. In Section 5 of these standards under Paragraph 3b you will note that electrical equipment mounted more than 5 feet above the floor may be of the ordinary type. This would indicate that locations 5 feet or more above the floor are considered as free of combustible gases. However, these same standards contemplate forced ventilation of these rooms and the use of modern anesthetizing machines so that the usual hazardous atmosphere is limited to a small area adjacent to the patient. In a large percentage of our hospitals forced ventilation does not exist and neither do they have modern anesthesia equipment.

Of all the anesthetic gases used, ethylene is the only one lighter than air. Therefore where gases other than ethylene are used and where other conditions are standard the five foot level is probably justified. Anyone planning to make an installation will therefore have to evaluate the conditions that are likely to exist before deciding it is safe to use ordinary electrical devices above the five foot level.—G.R.

Continuity of Ground

Q. *My question concerns the use of Chase Nipples, often called "conduit bushings", on a conduit system containing 440 volts 3 phase conductors. They are sometimes used in place of a close Nipple when fastening a condulet fitting to a switch or cabinet. Here is my question:*

Is it permissible to use Chase Nipples in lieu of double locknut and bushing when installing conduit containing conductors over 150 volts to ground?—E.H.B.

A. Sec. 2574 states that with voltages exceeding 150 volts to ground, the electrical continuity of the conduit system may be assured by the use of (as in 2572b) threaded couplings and threaded bosses on enclosures with joints made up tight where rigid conduit is involved. Therefore if the joint is *made up tight* it should be permissible to do as outlined in the question.—F.N.M.S.

Emergency Lighting

Q. *Does the emergency lighting circuit running down the corridor of a hospital have to be in a separate conduit or may it be pulled in the same raceway with other conductors? Do the letters on exit signs have to be six inches in height, as the only illuminated signs we can find have letters not more than 4½ inches in height?*—M.A.S.

A. The answer to your first question is found under Section 7022, which states that emergency lighting circuits shall be kept entirely independent of all other wiring and shall not enter the same raceway, fixture, box or cabinet. The illuminated exit signs with 4½ inch letters are suitable as they comply with the standards. The 6-inch letters are required when the exit sign is painted on the wall above the door. This information is not found in the N. E. Code but is contained in the Building Exits Code which may be obtained for one dollar from the National Fire Protection Association, 60 Batterymarch Street Boston 10, Masachusetts.—G.R.

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Along lamp axis:
45°-1.2 Candlepower per sq. inch
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70°-0.11 Candlepower per sq. inch
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45°-1.5 Candlepower per sq. inch
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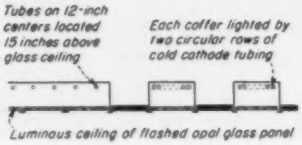
Luminous Ceiling For Information Lounge

Touring Aid Information is furnished as a complementary service to travelers and vacationers in the modern lounge on the main floor of the recently-completed Esso Building, Rockefeller Center, New York City. Any information can be thoroughly explained and illustrated beneath an all-luminous ceiling which delivers an average of 30 footcandles to desk levels. Two lighting treatments are used to produce these levels.

First, the main ceiling, consisting of square flashed-opal glass panels resting on inverted T-beams, is illuminated by parallel rows of cold cathode tubing mounted 15 inches above the glass and positioned on 12-inch centers.

Second, a series of recessed coffers are located immediately inside the entrance from Rockefeller Plaza and, like the central ceiling, are panelled by flashed-opal glass.

Two circular rows of cold cathode tubing illuminate each troffer. The rows measuring 16 and 22 inches in diameter respectively, are mounted 15 inches above the normal ceiling level. Cold cathode tubes operate at 120 milliamps, and transformers of 600-450-watt capacity are recessed into the upper side walls of the lobby. The lobby is modernistically decorated with specially designed furniture, rich drapes, selected veneer panelling and broadloom carpeting. One wall carries a large-scale map of the world, constructed with bronze ribbon outlines and copper-mesh solid surfaces, behind which are located speakers for musical transcription and local paging.


Tubes on 12-inch centers located 15 inches above glass ceiling
Each coffer lighted by two circular rows of cold cathode tubing
Luminous ceiling of flashed opal glass panel

Cross section through section of ceiling over entrance indicates positioning of cold cathode tubing in circular recessed coffers and above all-luminous central ceiling area. Transformers for system are recessed into upper side walls of lobby.

The lighting plan and architectural treatment was designed by Carson and Lundin, with Pollak and Grieve serving as consulting engineers. Cold cathode lighting is by the Cold Cathode Lighting Company, and the electrical work was by Eastern States Electrical Contractors, Inc.

The lighting of this lounge is one of many unique illumination installations at Rockefeller Center which is already recognized as a show-place for lighting treatments as well as a show-place for theatrical presentations and outstanding architectural designing.

Planned Lighting For A Meeting Room

Although not designed as a convention hotel, the new completely air conditioned Terrace Plaza at Cincinnati, Ohio, has a limited number of private dining and meeting rooms to accommodate small groups. One of these in particular, might be described as a sales manager's dream come true. It has a low stage at one end and contains lighting facilities flexible enough to meet the requirements of practically any type of presentation or demonstration. Seating capacity is from 80 to 100 people.

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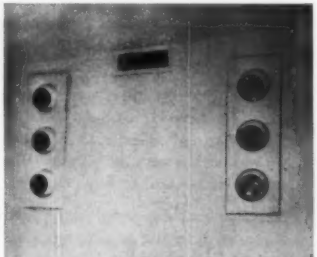
Over-all stage illumination is provided by a staggered system of ten 150-watt PAR-38 incandescent floods in angle reflectors recessed in the ceiling. Backlighting consists of a series of 40-watt fluorescent lamps (both white and gold) recessed in the stage floor.

A group of twelve 150-watt reflector spots (six on each side of the stage) in adjustable, louvered, housings can be used for highlighting stage displays. Two circuits provide control: One for the units near the front of the stage; the other for the rear units. With the downlights only, stage intensity averages 40 footcandles; is correspond-



Adjustable spots on stage wall highlight displays. Duplicate set is on other side of stage. Front and rear units controlled by separate circuits.

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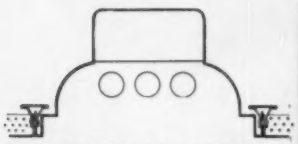

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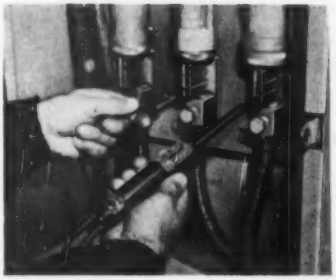

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Say "Goodbye to risky, time-wasting fuss in testing" with the 5 main safety features in the Knopp Voltage Tester: (1) exclusive Prod-Mounting Socket in housing making this tester easier, faster, and safer to use and ending time-wasting "three-handed" testing; (2) protection through Dual indication of voltage by solenoid and neon lamp working independently; (3) positive scale readings; (4) signal by hum and vibration; and (5) thorough insulation throughout, even to the sharp point of each prod.

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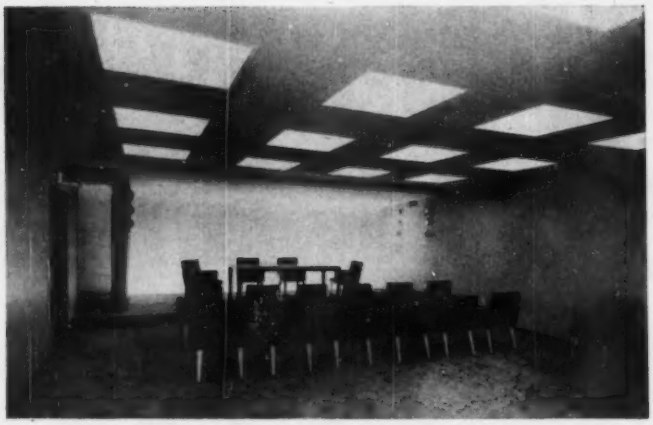


Meeting room lighting combines cold cathode ceiling panels for general lighting; fluorescent backlighting and incandescent floods and spots for the stage.

ingly higher when backlighting and wall spots are also used. All circuits can be conveniently controlled from an operator's cubicle at the left side of the stage in the auditorium.

Installation by Bertke Electric Co., Cincinnati electrical contractors on the project.

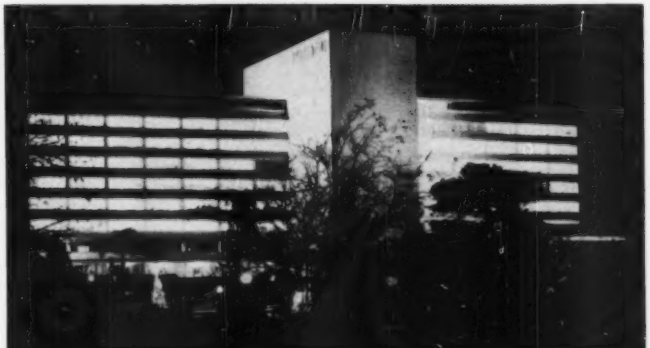
Modern Design Building Floodlighted

Floodlighting of the new Western Home Office of the Prudential Insurance Company of America in Los Angeles has demonstrated that large, vertical masses found in present day modern architectural design can be successfully illuminated.

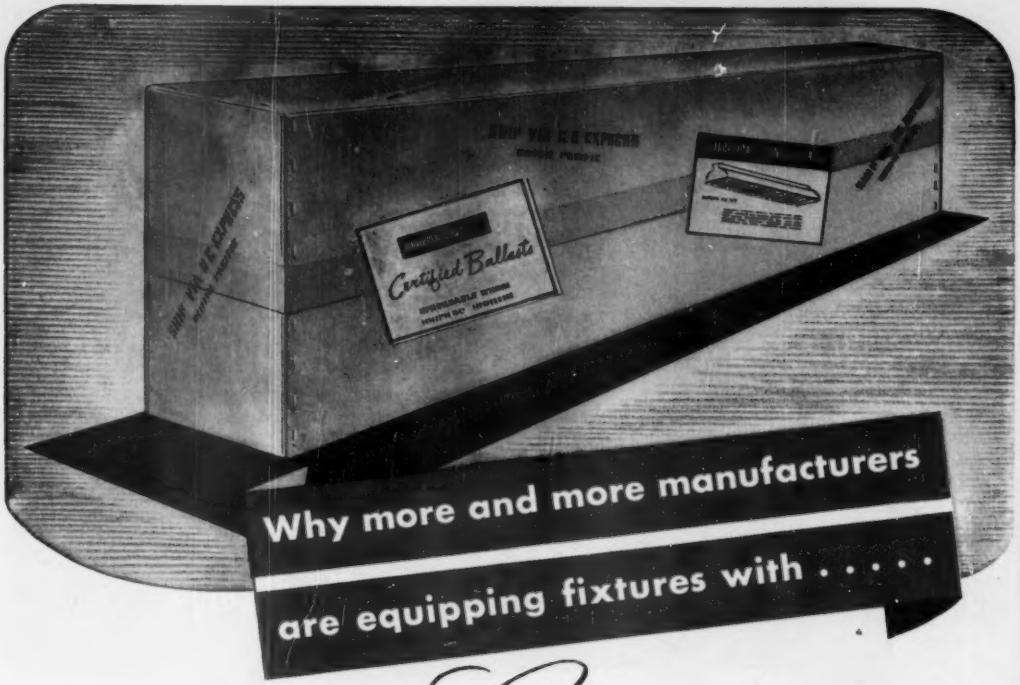
The building, with rectangular wings leading from a windowless central column 170 feet high, presented a lighting problem in that the area to be floodlighted consisted of large blank wall spaces on which light patterns were cast from the fluorescent tubing inside the building.

By using a total of 82 floodlights of the narrow beam, wide beam and medium elliptical beam 500 and 1000 watt sizes, the east, west and north sides of the large blank wall mass of the large central column were illuminated evenly. The floodlights were placed mainly on the second story roof, and partially on the roof of the two wings. The flooding of these walls with illumination served to accent the building, and washed out the objectionable patterns of light cast by the interior fluorescent tubing.

This floodlighting installation was designed by Ralph Philips, consulting electrical engineer. The floodlights were supplied by S & M Lamp Company, and the installation was made by Fischback & Moore of California, Inc., electrical contractors.



Floodlights evenly illuminate the huge 170-foot high windowless central column of the modern design building of the Prudential Insurance Company of America in Los Angeles.



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Other worthwhile advantages of CERTIFIED BALLASTS include: *Rated Light Output* and *Long Dependable Performance.*

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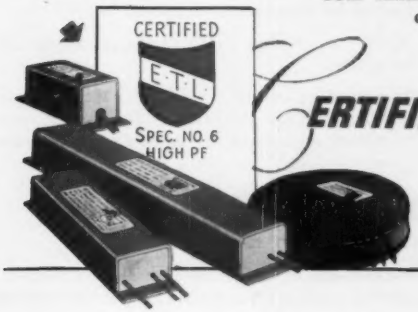

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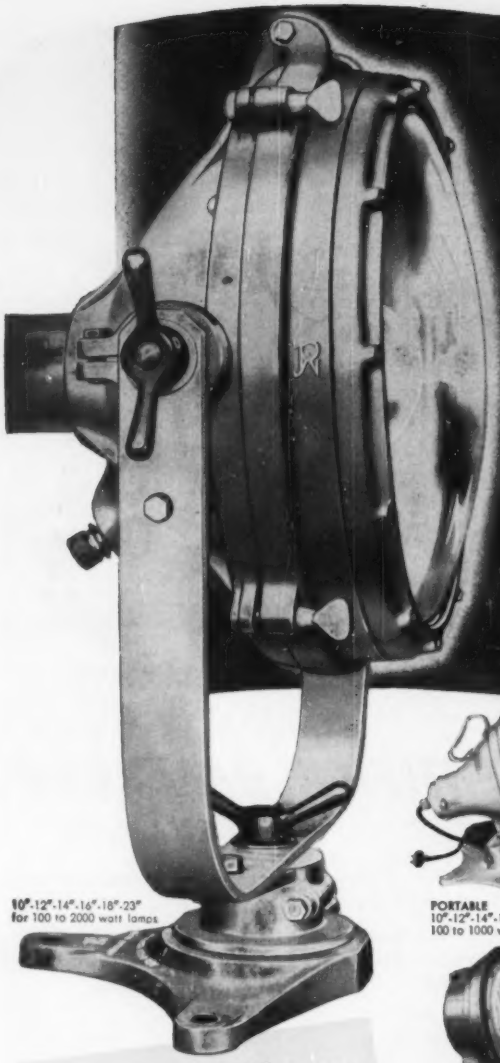

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Industrial Electrification

Automatic Time Switches for Industry—Part III

Representative applications plus installation and maintenance hints on automatic time switches.

By George E. Sangster
Sales Research Manager
Sangamo Electric Company
Springfield, Illinois

IN the previous article, a suggested procedure for properly selecting a time switch to fit a specific application problem was outlined. Before progressing to the installation and maintenance categories, let's review a few typical "examples" to illustrate and emphasize the technique of proper selection.

Example: A factory desires to control with a time switch the company's 1800-watt electric sign on 2-wire 120-volt power supply with constant frequency and infrequent power interruptions. Cycle—ON at 7:00 P.M. and OFF at 12:00 midnight throughout the year. Code does not require breaking both sides of the circuit.

A time switch with the following characteristics was selected:

Drive—Straight synchronous, 120-volt, 60 cycle motor. Switch location can be indoors remote from sign and accessible for occasional resetting of dial.

Dial—Ordinary 24-hour, with one ON and one OFF lever, set for 5-hour ON time, repeating each day at the same time regardless of sun time.

Switch Mechanism—Single-pole, single-throw for 120-volts, rated 15 amperes per pole (or 1800 watts) or more.

Switch Case—Simple, inexpensive type—need not be gasketed.

Example B: A factory in Chicago has two yard lighting circuits, feeding out from a central switch location, to be automatically lighted with 3-wire, 120/240 volt 60 cycle supply. Interruptions are infrequent and frequency is constant. Each circuit has about 25 amperes on 120 volts, or 3,000 watts, of lighting. In the winter lights are to go ON at 5:30 P.M., OFF at 11:00 P.M., ON at 6:00 A.M., OFF at 8:00 A.M. Proposed switch location is outdoors in an accessible spot.

Selected switch was as follows:

Drive—Straight synchronous 120 volt, 60 cycle motor, although 240 volts is available.

Dial—Ordinary 24-hour dial with two sets of levers. (Check literature to make sure two operations are possible). For two operations a day—minimum time 2 hours. Cannot use a single switch with astronomic dial because *two* operations per day are desired, but a duplex switch with two astronomic dials will do the job if the economics justify the expenditure.

Switch Mechanism—Since time switches are rated amperes/pole or watts/pole, the best solution is to use a double-pole single-throw time switch with what the trade calls a "split load". Consists merely of running one circuit load across one switch blade of the double pole, and other circuit load across the other blade. Motor should be connected across switch terminals at motor rated voltage on the *supply* side of the switch load contacts. Double-pole, single-throw, with capacity of 25 amps. per pole, or 3,000 watts per pole as a minimum.

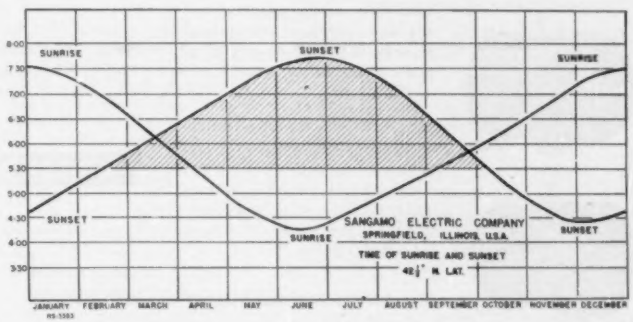

FIG. 17—Economy of astronomic dial is shown by crosshatched area in this chart of sunrise and sunset time at 42½° latitude (Chicago). Ordinary dial would turn lights on at 5:30 P.M. the year round; astronomic dial operates at actual sunset time.

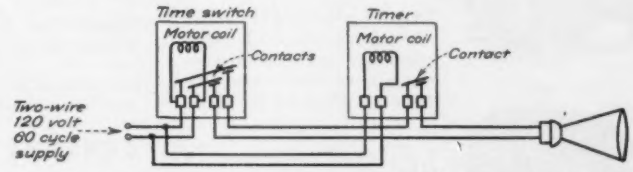

FIG. 18—Rest call buzzer hook-up for sounding 5-minute rest period signal every hour. Time switch closes circuit at beginning of work period; permits timer to sound 3-second blasts at preset times. Switch and timer motors run continuously. Double-pole, single-throw time switch automatically opens circuit after work hours. Carryover drive on time switch prevents buzzers operating off schedule in case of circuit interruption.

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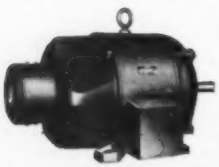
Type SC—TOTALLY ENCLOSED FAN COOLED—protects against dusts, mist or fog detrimental to the vital parts of the motor. The inner frame protecting the motor is sealed to keep out harmful matter.

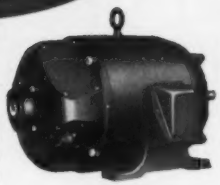
Type SC—EXPLOSION PROOF protects against atmospheres charged with explosive dusts or gases. They carry Underwriters' label for specific kinds of hazards.

Type SR—SLIP RING—wound rotor motors are suitable for applications requiring low starting current with high starting torque, reversing, or adjustable speed.



Type SY—SYNCHRONOUS MOTORS—suitable for continuous operation at a uniform load for power factor correction.

SINGLE PHASE

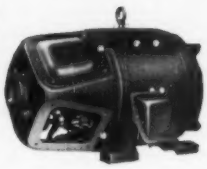


Type RS—REPULSION START INDUCTION—single phase brush lifting motor suitable for applications requiring high starting torque with low starting current.

Type CSH—CAPACITOR START INDUCTION—single phase motor suitable when high starting torque with normal starting current is required.

Type SP—SPLIT PHASE, INDUCTION—single phase motors—suitable for light starting duty.

DIRECT CURRENT



Type DN—DIRECT CURRENT MOTORS—suitable for use where direct current is available or its use desirable.

These illustrations are typical of Century's complete line of motors. Others available include gear motors, generators, AC and DC motor generator sets.

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Century C MOTORS

Switch Case—Outdoor type, or type with gasketed cover mounted in weatherproof housing.

Example C: If the lighting circuits in Example B are to be lighted between sunset and sunrise, the following switch would be chosen:

Drive, Switch Mechanism and Switch Case: The same as Example B.

Dial—Astronomic type, for operation varying daily with sunset and sunrise at 42½ degrees latitude. The average cost/kilowatthour is three to four cents, which, based on this lighting load (total 6,000 watts) will be about 20 cents/hour.

Figure 17 shows the sunrise and sunset times at 42½ degrees (latitude of Chicago). A line at 5:30 P.M. represents the time an ordinary dial switch would turn lights ON. Therefore, *the crosshatched area is the hours of unnecessary lighting.*

Based on 20 cents per hour for this load, and a total of approximately 240 wasted hours of lighting, the total unnecessary cost is $48.00 per year. The average astronomic dial first cost is $10.00 to $15.00 more than the ordinary 24-hour dial, and is economically justified for even a minor percentage of the indicated annual saving in this case.

It has been assumed here that the factory operating personnel will not periodically change the setting of ordinary switch dial levers which might be used on this job. This exaggerates the probably wasted hours, of course; but, everything considered, the astronomic dial is recommended for the probable savings on this job.

Switch Case—Same as Example B.

Example D: A manufacturer wants a time switch to regulate the relays controlling an electric furnace having a rating higher than any available time switch. This furnace to be on full heat when employees arrive at 7:30 A.M. It takes the furnace about a half-hour to heat up. Furnace to be kept at a low heat during the night, from 5:00 P.M. until morning, and from Saturday at 1:00 P.M. until Monday morning. Power supply 120 volts; frequency constant at 60 cycles; switch location accessible, indoors; power interruptions seldom occur.

For this specific application, the following switch was selected:

Drive—Straight synchronous, 120-volt motor. As ambient temperature will be high, motor should be lubricated for temperature extremes.

Dial—Ordinary 24-hour dial. Two operations per day—two levers, one to be set for ON at 7:00 A.M., other OFF at 5:00 P.M.

Switch Mechanism—As a relay will control the load, the ampere capacity of time switch is no problem. Assuming 2-wire control of two separate relays, use single-pole time switch. As furnace is always either on high heat ("A" circuit) or low heat ("B" circuit), use double-throw switch. For furnace to remain on low heat over *Sunday, use omitting device* (will prevent "A" circuit from coming on). To place furnace on low heat at 1:00 P.M. Saturday, use *Advance Time Operation Device.*

Switch Case—Ordinary indoor case.

Example E: A factory desires to control automatically the lighting in an automatic pumping station several miles distant from the main plant. Power supply is 120-volt, 60 cycle frequency (constant), power interruptions are infrequent, but switch location is not convenient to resetting the dial to the correct time after the interruptions.

The following switch application solved this problem:

Drive—Synchronous-carryover, with 120-volt, 60 cycle motor. Switch will be relatively inaccessible, and with the possibility of current interruption. To assure protective station lighting on the desired schedule, the carryover feature is desirable to keep dial on time in spite of interruptions.

Dial—For the maximum economy in lighting costs, use astronomic dial, selected for proper latitude, to turn lighting ON and OFF with varying sun time.

Switching Mechanism—Double-pole, single-throw switch, each pole controlling a separate circuit; two circuits used, as a precaution, to provide continuous lighting.

Switch Case—As switch location is indoors and clean, an ordinary indoor case is suitable. For damp atmosphere, use a gasketed case with a good finish.

Example F: A factory plant engineer wants a time switch to turn watch station lights on from 6:00 P. M. to 6:00 A.M., and to turn certain building entrance lights on at 6:00 P.M. and off at 1:00 A.M. Power supply 120-volts, 60 cycle. Switch location accessible for checking time daily on regular work shift.

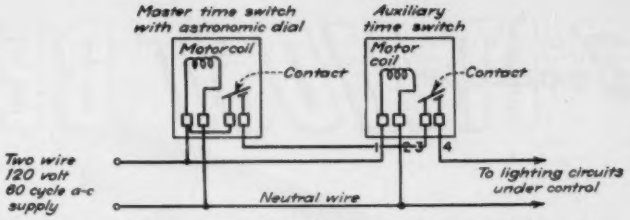

FIG. 19—Yard lighting control circuit has master and auxiliary time switches. Master switch riders are set to turn ON and OFF for standard all-night burning; auxiliary switch riders are set for part-night "cut-off" and early morning "cut-on" as for shift changes. To discontinue early morning burning, jumper auxiliary switch terminals 3 and 4 and reset (at end of early morning burning) master switch "off" rider to "cut-off" at the ordered part-night cut-off.

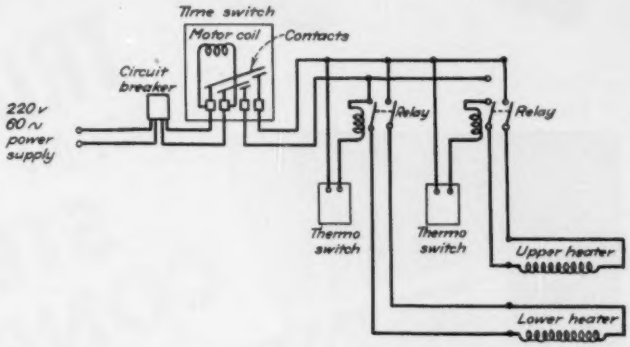

FIG. 20—Plastic molding press heaters are controlled by time switch circuit as shown. Switch turns heaters on before working hours for preheat, then thermo-switches maintain proper temperature. Circuit automatically turned off at night. Time switch is a double-pole, single-throw, synchronous-carryover drive with 220-volt motor. A 24-hour dial with one set of levers turns circuit ON at 6:00 A.M. and OFF at 4:30 P.M. Omitting device prevents ON operation Saturdays and Sundays.

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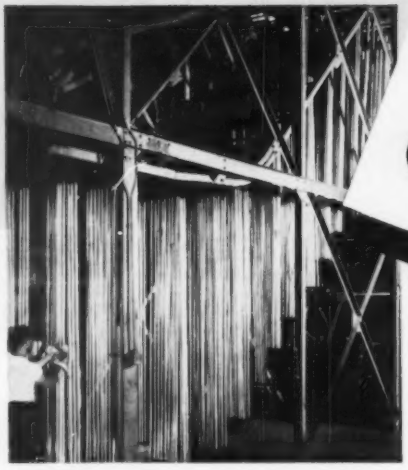

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Proper switch for this application would be the following.

Drive—Straight synchronous, 120-volt 60 cycle motor.

Dial—Standard 24-hour, with two ON and two OFF levers, on a two circuit switch.

Switching Mechanism—Two-circuit, each single-pole single-throw, rated per pole for maximum lighting load to be on each circuit.

Switch Case—Ordinary indoor type.

The foregoing examples cover only a very small part of time switch applications and are intended to merely give an idea of how to attack a problem of time switch control. For problems much more complicated than any of these, contact a time switch manufacturer for the answers.

The competitive time switch market today insures higher quality for higher price. *When selecting a time switch consider the long range economics of maintenance as well as the length of time over which the first cost of switch and installation will be spent.* This amortization of first costs usually will be lowest with a high-quality, long-life switch, although the price may be somewhat higher than an inferior switch. Remember that the average cost of installing an ordinary time switch is about $10.00 in addition to the price of the time switch. Then ask the following questions:

1. *How long is this time switch to last?* In other words, should one buy a high quality time switch to last 10 to 15 years, or a low cost switch to last 2 to 4 years. Remember that the cost includes not only the new replacement time switch but also attendant installation costs.

2. *Will switch likely have long periods between lubrication and minor maintenance operations?* If so, this means probable low annual maintenance costs.

3. *What are the manufacturer's repair facilities?* Some establish authorized repair stations and agents, or make repairs at the factory. Others make no provisions. In other words: will service be good or poor in case of trouble.

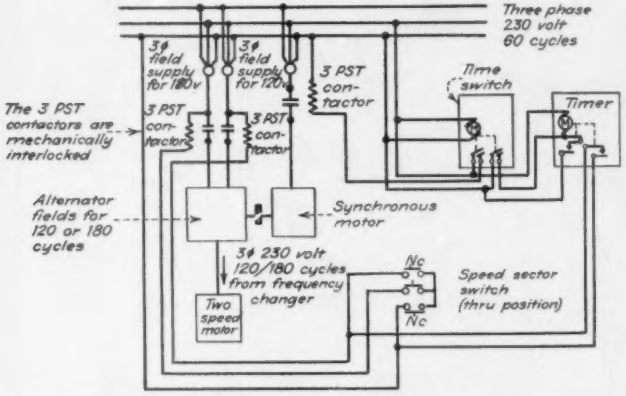
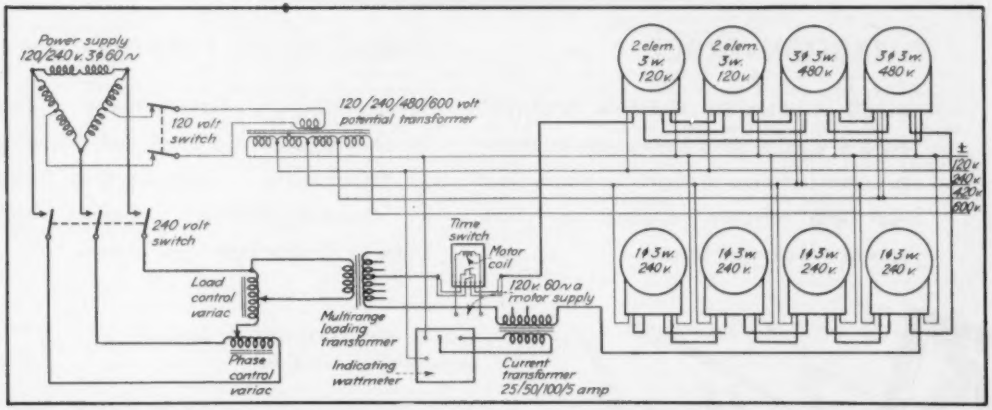


***FIG. 21**—Control circuit for automatic wheel fitter incorporates time switch, timer and frequency changer; turns motor on one hour prior to work start to allow parts to expand to normal running condition. Double-pole, single-throw, carryover time switch starts timer and, through relay, starts frequency changer (varies speed of synchronous motor). After three minutes timer shuts off time switch which automatically resets for the next morning. Timer makes one complete revolution every 30 minutes. Frequency changer and motor shut off manually at end of work shift. Omitting device on time switch prevents ON operation on Saturdays and Sundays.*

Installation

Installing and connecting a time switch is a relatively simple job. All the manufacturers furnish complete wiring diagrams and mounting instructions. *Follow these instructions and the installation can't go wrong.* Time switches are generally housed in steel cases that have obvious mounting facilities. They are generally mounted on a wall, with single or multiple knockouts in the sides, bottom and, in some cases, the back for conduit connections.

Most standard time switches are furnished for indoor use, although a few manufacturers have outdoor cases available. If the time switch is to be mounted outdoors, it is a simple matter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120 volt switch
240 volt switch
Time switch
Motor coil
120 v. 60 cy. motor supply
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Multirange loading transformer
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2 elem. 3 w. 120 v.
2 elem. 3 w. 120 v.
3ϕ 3 w. 480 v.
3ϕ 3 w. 480 v.
1ϕ 3 w. 240 v.
1ϕ 3 w. 240 v.
1ϕ 3 w. 240 v.
1ϕ 3 w. 240 v.
± 120 v. 240 v. 420 v. 600 v.

***FIG. 22**—Time switch control circuit for automatically controlling meter testing between work shifts. Load is manually applied and adjusted to electric meters on test before work shift ends. Time switch applies adjusted overload for three ON periods of 1½ hours, separated by three 1½-hour OFF periods during night. After third overload, time switch opens load current circuit but leaves meters on potential ready for calibration. Since load current is higher than rating of the carryover switch, a double-pole, single-throw unit is used with the two poles connected in parallel. Switch has 24-hour dial with omitting device for weekends. A 7-day calendar dial could also be used.*

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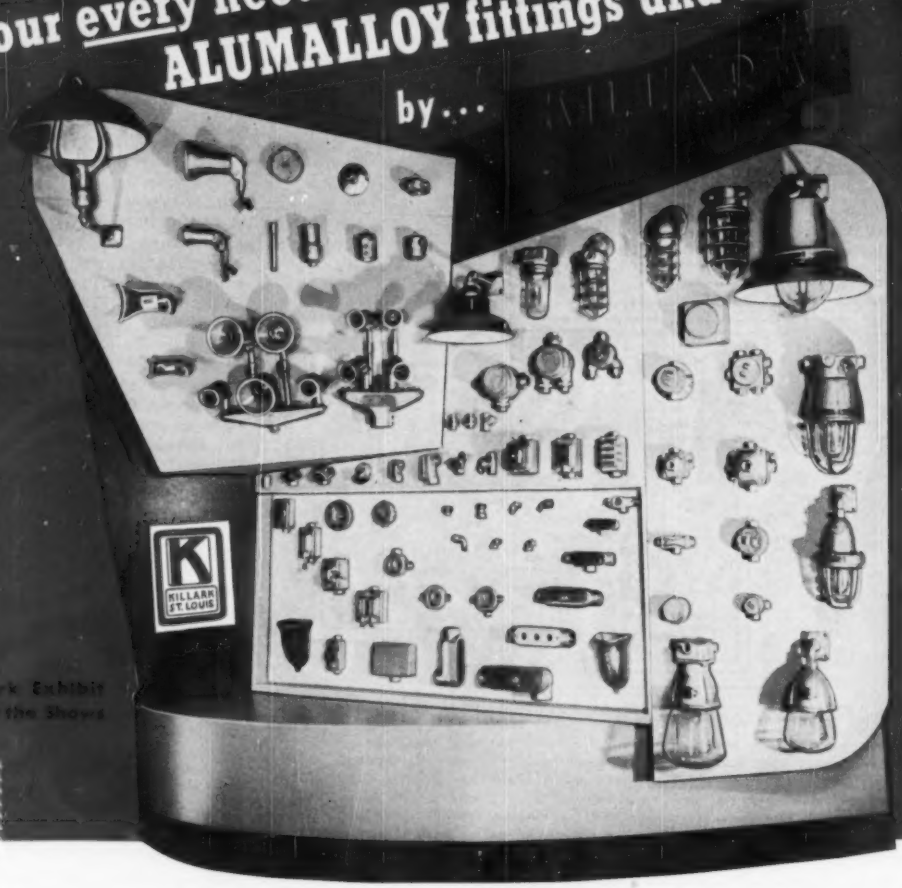

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SAINT LOUIS 13, MO.

to enclose it in a box of some type. Many outdoor advertising companies do this—not only for the protection afforded against the weather, but also for protection against theft and damage.

When wiring a time switch, remember that it is nothing more than an ordinary switch driven by an electric motor. The motor must have the voltage for which it was built.

At the time of installing a switch with a 24-hour dial, be sure to set the time on dial in the "night" or "day" segment, opposite the fixed time pointer, with levers at time switch operations are to occur.

On 7-day dial, riders should be securely fixed at points on dial for a day and time operations are to occur. These settings should be made and the operations of the switch checked before factory processes operations, or important lighting circuits are turned over to the time switch for its automatic control.

Maintenance

A good time switch, *when properly selected for its application*, is a relatively trouble-free device and seldom requires attention other than lubrication about every two years, depending on the make. The use of Silicones promises to extend this period between lubrications. A case with a gasketed cover and a good finish is an important factor in eliminating time switch troubles and minimizing maintenance by protecting the mechanism from dirt and moisture.

All manufacturers guarantee their time switch for at least one year against inherent defects, but the average life of their various products depends largely on the design and the materials used in their construction. In the competitive time switch market *the relative price is a fair measure of the probable relative performance without maintenance*. In general, time switch maintenance will be minimized by proper switch selection for the job.

When trouble arises, the common tendency is to blame the time switch. In nine out of ten cases, however, the time switch is all right. However, if any of the following difficulties should arise, check the points listed below:

Switch doesn't operate on desired cycle:

1. *Check Position of Levers.* Be sure ON and OFF levers are in the correct portion of day, if dial is a 24-hour type. On a 7-day dial, check riders for proper *time* as well as *day* setting.

2. *Riders Slipping.* Tighten trippers or riders if they are slipping on the dial.

3. *Frequency Not Constant.* A slow or fast motor results from a frequency supply that is not constant. If frequency cannot be controlled, the only remedy is an electrically-wound switch.

4. *Power Interruptions.* Power supply interruptions cause a corresponding error in time on the dial. If such interruptions occur, reset the dial.

5. *Excessive Loads.* Check to see that the load has not been in excess of constant rating of time switch. Overloads will cause contacts to burn out and perhaps "freeze" in ON position, or to burn away so much that actual contact cannot be made. In this case,

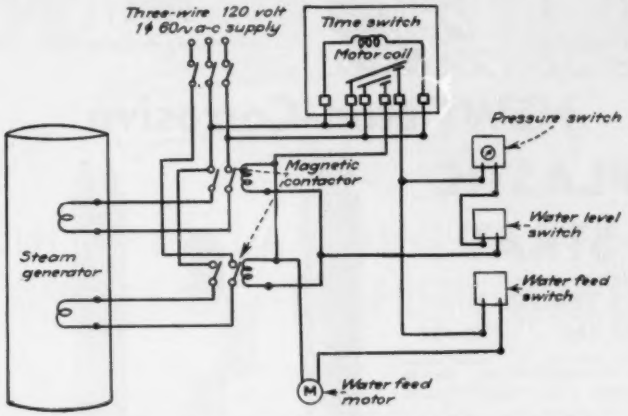


FIG. 23—Steam generators, used for cleaning watt-hour meter jewels, are automatically controlled by time switch circuit shown; are brought up to operating temperature 1½ hours before work day begins. Double-pole, single-throw, synchronous-carryover time switch controls two legs of a 3-wire power supply. Unit has one ON lever for 6:00 A.M. and one OFF lever for 4:30-P.M.; has a 24-hour dial with an omitting device for Saturdays and Sundays.

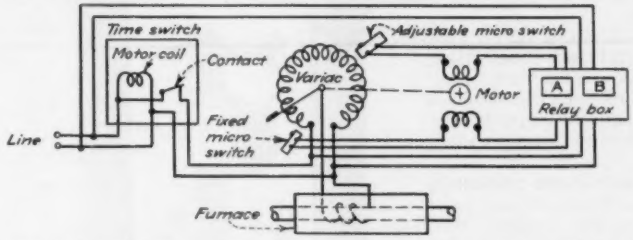


FIG. 24—Carbon-train furnace heating element (long quartz tube) is automatically controlled by this time switch circuit. At preset time, time switch starts Variac motor which increases heater current until pointer contacts adjustable Micro-Switch position which shuts off motor to maintain current value. At furnace shutdown, time switch contacts open at the preset time and relay B maintains current flow while relay A causes Variac motor to reverse and lower pointer down to fixed Micro-Switch position which turns motor off and opens relay B. Switch has 24-hour dial with two levers, is a straight synchronous type.

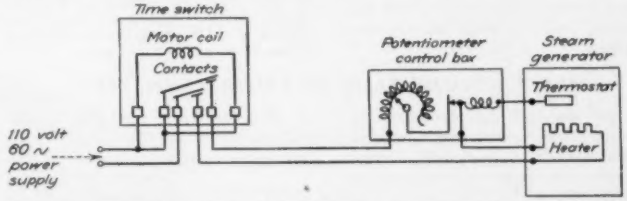
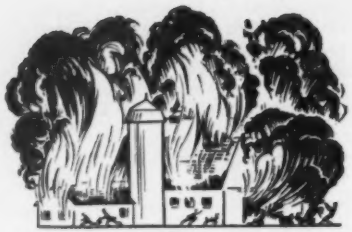


FIG. 25—Automatic control of fast rate steam generator is accomplished by time switch circuit shown. Switch turns generator ON at 6:15 A.M.; OFF at 12:00 noon; ON at 12:40 P.M. and OFF at 4:30 P.M. Switch has synchronous-carryover drive, 24-hour dial, and omitting device for Saturdays and Sundays.



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FIRE!
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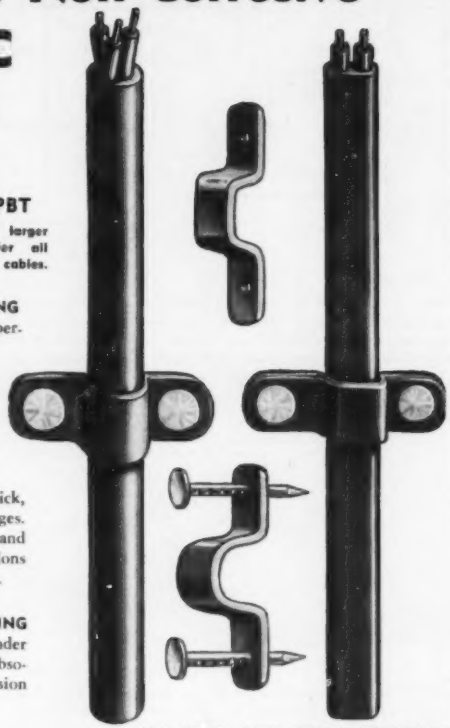
CPC-PBT — round larger opening for all triple wire cables.



HOLDS NAIL FOR DRIVING (Use copper nail for added permanency)

NEW SAFETY. Long life installation for all types of open wires, cables and cords.

NO CUTTING EDGES. Thick, pliable with ROUNDED edges. Vital Protection from shorts and arcs especially under conditions of vibration, sway, wind, etc.

NO RUSTING OR CORRODING As so frequently found under wet or acid conditions. Absolutely waterproof and corrosion proof!

COMPLIES WITH REA Farmstead Wiring Requirements, for a non-corrosive strap in all wet, acid and corrosive locations such as buildings housing livestock, to fasten Neoprene jacketed wires, and Romex cable. By using a No. 12 x 1" Copper Slating Nail a job is assured that absolutely will withstand all corrosive conditions.

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TOUGH PLIABILITY—Unusual strength by test—SLIGHT degree of flexibility greatly increases life of any installation, especially under conditions of vibration, strain, wind and weather, etc.

HEAVY VOLUME SALES IN CENTRAL NW TEST!

No new electrical item introduced in recent years has received such a resounding welcome! In a brief NW Central area sales test, farmers everywhere and the Electrical Trade purchased on sight and heavily. Now CPC Non-Corrosive Straps are available nationwide.

Write today for full details, prices.

COMMERCIAL PLASTICS CO.
MERCHANDISE MART • CHICAGO 54

replace contacts of time switch—but *also correct load condition.*

6. *Dirty Gearing Mechanisms.* This condition will cause a switch to slow up. Clean with a stiff brush and solvent as recommended by the manufacturer. Necessity for cleaning and lubricating will vary with the operating conditions surrounding the switch location and protective housing in dirty or damp locations. With normal care in switch location, a trouble-free operating life of at least two years should be realized.

7. *Lubrication.* Check to see if lubrication has deteriorated. If so, use only lubrication recommended by manufacturer. His recommendations are based on lubricants best suited for various parts of his product.

8. *Contact Gap.* Switch contact gap and/or pressure may be out of adjustment. These are factory set and *should not be readjusted except under specific instructions from the manufacturer.*

Switch fails to operate at all:

1. *Energized Circuit.* See that circuit is energized at the switch power supply terminals.

2. *Proper Voltage.* See that voltage across motor is at rated value. Higher than rated motor voltage may have burned out the motor. If so, replace motor. If voltage is too low to start motor, apply rated voltage.

FIG. 26—Built-in time switches are part of control equipment in the Atlas Weather-Ometer (accelerated weathering test apparatus). One switch is converted to a cycle meter by substituting special 24-hour cams for 24-hour dial. Each rise in cam face produces simulated sun light; each cam indentation produces a water spray (rain). Second time switch has 24-hour dial with one OFF lever to terminate test or shut down unit at any predetermined time.

Cut Cost

...IN THE PLANNING STAGE--

Specify SIMPLEX-ANHYDROPRENE CABLES

When planning transmission and distribution systems for installation in conduit, in underground ducts, or in open air raceways in buildings, you'll take a big step toward low-cost operation by specifying Simplex-Anhydroprene Cables. ... Their simple construction, stable electrical and physical properties, and versatility provide many advantages profitably realized in low purchase cost, low installation and maintenance costs and long service life. ... Some of these cost-cutters are included in the checklist below. But even they are only a few of many available to you when you install Anhydroprene Cables. For the complete Anhydroprene story, plus specification data, drop us a card today for Bulletin 115. (Fill out and mail the coupon below.)

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- No Potheads Needed at Terminations

Simplex-Anhydroprene Cables are recommended for plant and shop wiring, for instrument wiring, for use as underground primaries and secondaries, transformer leads and pole line risers, and in signal and control circuits.

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3. *Tight Connections.* See that power supply connections are energized and motor lead connections are tight.

4. *Proper Connections.* Be sure all *connections are made to proper terminals.* Some cases have shown that motor has been connected on the load side of switch blade. Thus time switch would stop as soon as switch blade opened. Reconnect according to manufacturer's wiring diagram.

5. *Ambient Temperature.* Switch may be in location where ambient temperature is too cold, particularly for motor lubrication. Move switch to warmer location or replace with unit having lubrication designed for lower temperatures.

6. *Check Gearing Mechanism.* It may need cleaning, although this should be necessary only if switch has been in service over two years under adverse surrounding conditions.

Where to have repairs made:

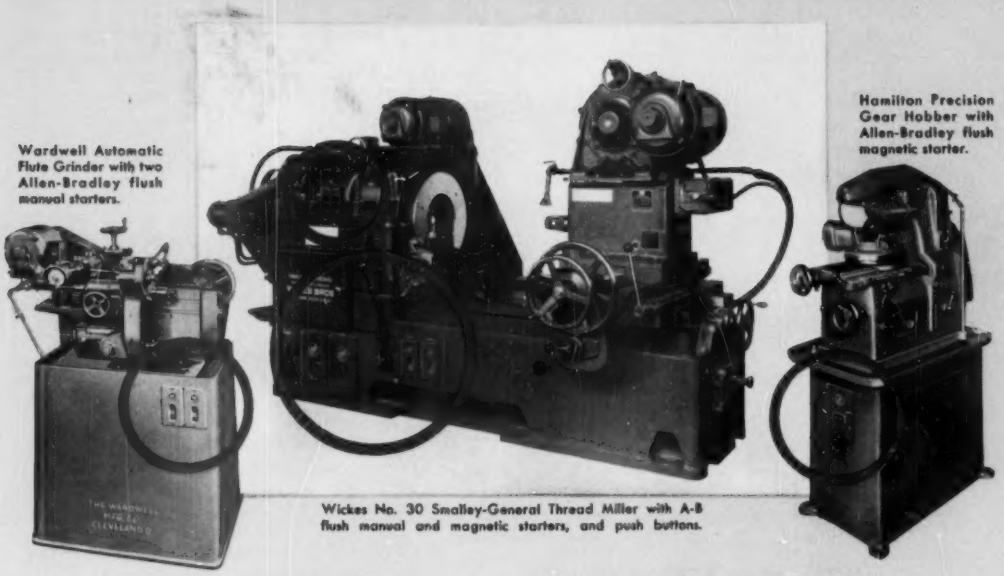
If repairs are such that the user prefers not to make them, the manufacturer may recommend a reliable repair station in the customer's locality. The manufacturer may prefer to make factory repairs and bill the customer.

This series of articles was designed to acquaint those having the responsibility for adopting automatic control with the possible uses of time switches for this purpose in industry; also to assist in the selection of a time switch that will do the job most efficiently and economically. The information herein is intended only as a guide. Each manufacturer has many specialties for a specific application that can be studied in the literature provided by him. Here, the attempt has been to show only the general variations and some typical examples of common types of switches.

There are many types of applications for automatic time switch control which have not been mentioned. These include operations requiring automatic control of water flow; controlling ventilators and fans; starting and stopping automatic screw machines; the automatic switching of heating elements "on" and "off" in assembly line glue pots, lead melting pots or similar equipment, the latter saving hundreds of dollars annually by the use of even one time switch, as well as avoiding costly burns or fire. Manufacturers of electrical equipment economize also by using time switches to heat soldering irons before work time so that they will be at full heat when work starts on the assembly line; also turning them off automatically during the noon recess and at night to save on unnecessary use of power. Process operations such as heat treating, water chlorination, engraving and food processing, are made more accurate, safe and economical with the use of time switches.

Built-in Motor Controls

modernize the appearance of your shop



Wardwell Automatic Flute Grinder with two Allen-Bradley flush manual starters.

Hamilton Precision Gear Hobber with Allen-Bradley flush magnetic starter.

Wickes No. 30 Smalley-General Thread Miller with A-B flush manual and magnetic starters, and push buttons.

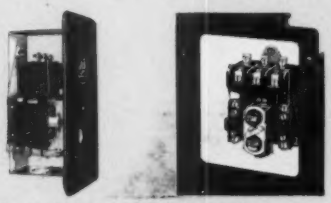
Many machinery builders are now equipping their motorized machines with flush mounted controls. Above are a few examples of machines with "built-in" push buttons and motor starters.

Notice the smooth appearance of the machine bases. There are no control boxes to break the streamlined design . . . no exposed conduits to clutter the installation.

When designing special machinery for your own plant, streamline its appearance with built-in controls. We shall be glad to send descriptive literature on these flush type starters.

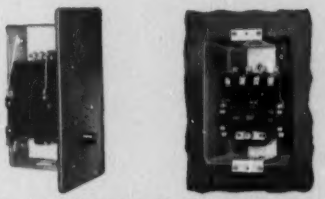
Allen-Bradley Company, 1316 S. Second St., Milwaukee 4, Wis.

BULLETIN 609 MANUAL STARTER



At left—A-B flush mounted manual starter in open type construction for enclosed recesses. At right—A-B manual starter in flush mounted cabinet for installation in open recesses.

BULLETIN 709 MAGNETIC STARTER



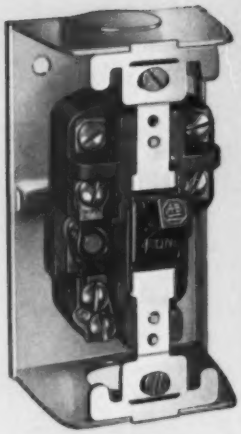
At left—A-B flush mounted automatic starter in open type construction for enclosed recesses. At right—Form 1 A-B unit installed in enclosed machine recess, with cover off.

A-B Quality

ALLEN-BRADLEY

QUALITY

TROUBLE FREE MOTOR STARTERS



with RELIABLE OVERLOAD PROTECTION

For Fractional Horsepower Motors

The National Electrical Code requires overload protection for all fractional horsepower motors started automatically or by remote control. The Bulletin 600 switch satisfies this need. Its dependable, accurate, thermal breaker trips the switch under a sustained overload, and protects the motor against burnout.

QUICK MAKE AND BREAK CONTACTS—The simple, rugged, over center mechanism provides quick make and quick break contact action . . . therefore, long contact life.

GENEROUS WIRING SPACE—Though compact, this small switch provides plenty of wiring space. Its metal cover slips off, exposing front and two sides.

EASY TO INSTALL—No need to remove the starter from the enclosure during installation—saves at least 10 minutes of installation time.

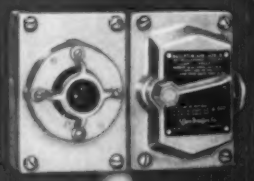
ATTRACTIVE APPEARANCE—This starting switch, with its clean, modern lines, is a sales asset to any motorized machine.

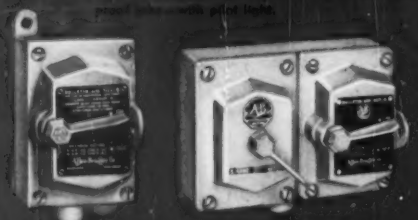
Allen-Bradley Company
1316 S. Second St., Milwaukee 4, Wis.

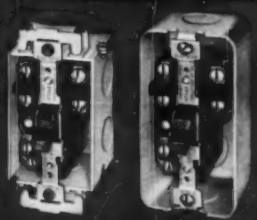
ALLEN-BRADLEY

BULLETIN 600 STARTING SWITCHES FOR SMALL MOTORS

A-B Quality







In the News

Pittsburgh Exposition Stresses Electrification Of Industry

Realizing the importance of industrial electrification, and seeking information on new electrical materials, products, installation techniques and maintenance hints, more than 2500 contractors, electricians, engineers, architects, executives and students converged on Pittsburgh to attend the First Annual Industrial Electric Exposition. Sponsored by the Electric League of Western Pennsylvania and presented in the William Penn Hotel during the three-day span from November 29th to December 1st, the exposition included the displays of 41 exhibitors and featured a kick-off luncheon, five technical conferences and an interesting program of demonstrations and entertainment. Emphasizing the industrial viewpoint, the conferences discussed the benefits of heating, wiring and control, lighting, plant layout, communications and photography.

L. R. Boulware, vice president, General Electric Company, launched the program by discussing "The First Job for Us All".

"Economic illiteracy among businessmen, employees and representatives in government, unions, education and the clergy is alarming. Too many of us do not understand how we got this standard of living that's the envy of the rest of the world. Too many of us do not understand the nature and function and relationships of wages, taxes, prices, profits, savings, capital, money, technology, incentives, competition and risk-taking vs false security," Mr. Boulware pointed out. "We don't like the proposals for government-supported food price and farm income schemes; for putting the government into socialized medicine; for giving away abroad a lot of subsidy-stimulated surpluses as though that were a sensible way to bolster our economy at home. We see this misrepresented, 'sold' to the public by the public's own representatives while the costs are being collected from the public in taxes.

"Despite these real causes, we see the profits of business being blamed for high prices in spite of the fact that we have provided 60 million jobs, and are handing over taxes to the federal government at the rate of about $40 billion a year. And get this. Half of this $40 billion is being spent to ward off the foreign collectivist menace while here at home many are joyously embracing one after another of the ideas, influences and features of this same collectivism we are fighting with our billions to avoid.

"Too pitifully few businessmen have the alertness to know when they have been pushed beyond the commercial field into the political arena. Silence by us businessmen and other free enterprisers in the last 30 years has guaranteed the coming of the things that now threaten us.

"Let us businessmen stop being Nervous Nellies about this. There is no such thing as a humiliating defeat in a just cause. Let's take the leadership that's expected of us in this patriot's job of standing up, speaking out and being counted—no matter who has to be contradicted."

In the first technical assembly, M. Glenn Jarrett of the Bell Telephone Company presented a discussion of micro-wave radio, demonstrating by the use of a miniature transmitter and receiver its application to the transmission of telephone messages and television programs. Mr. Jarrett was followed by W. F. Swann of the Eastman Kodak Company who introduced a sound-color film on "Functional Photography in Industry" which was shown publicly for the first time, and which presented the many applications of photography for industrial purposes.

F. W. McGRAW, ***chief electrician for the Union Switch and Signal Company, discusses the benefits of high-level illumination in an industrial plant for delegates to the First Annual Industrial Electric Exposition sponsored by the Electric League of Western Pennsylvania and presented in the William Penn Hotel, Pittsburgh.***

The session on Industrial Heating brought together C. E. Peck, engineer-manager of industrial heating for the Westinghouse Electric Corporation; C. F. Krieser, assistant sales manager for Edwin L. Weigand; and J. E. Kolb, manager of Weigand's Cromalox Radiant Heating Section. Mr. Peck discussed applications of resistor type electric furnaces in the fields of bright annealing and hardening, gas carburizing, furnace brazing and the sintering of powdered metals. "Quality factors must justify electric heat", he said, "and cost is not the deciding factor. Other things to be considered are latitude of control, control combined with materials handling, cleanliness and controlled atmospheres."

In a two-man conversational slide presentation, Krieser and Kolb discussed more than 100 ways to apply electric heat to liquids, air, gasses, machine parts and process equipment. In their attention-compelling duologue which was presented with the aid of props ranging from water pistols to slides of whistle-prompting nudes, they effectively stressed the advantages of electric heating: initial low cost, flexibility, compactness, safety, 100 percent load factor, use of off-peak loads, 100 percent conversion, 24-hour-readiness, temperature control, absence of fumes and flames, portability, cleanliness and silence.

The session on Industrial Wiring and Control brought together three more authorities: L. C. Carpenter from the industrial power division of General Electric; C. M. Boardman, supervisor of power utilization in the industrial sales department of the Duquesne Light Company; and P. M. Hissom, electrical engineer for the American Cyanamid Company. In order, they spoke on the components of an industrial distribution system, protection and control of electrical apparatus, and maintenance of electrical equipment. Mr. Hissom stressed the importance of established maintenance schedules and systems, mentioning the wisdom of establishing simplified working arrangements, definite instructions for the job, printed forms and proper routing of data to responsible personnel. In defining Preventive Maintenance, he quoted one of his electricians who had mentioned that it was "doing something *now* when you don't *have* to do it so you won't have *it* to do later when you *have* to."

Presenting an effective demonstration on Industrial Plant Layout, J. L.

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WIRING DEVICE
Line
HAS EVERYTHING
FOR RESIDENTIAL WIRING
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The wiring devices shown above represent just a few of the hundreds in our complete line. And it's your line! In it, you have everything you need to meet the most complex specifications — quickly and easily. More than 35 different classifications of wiring devices to choose from! In all, more than 1800 individual, cataloged units—everything you need for the ultimate in convenience, utility and dependability.
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"Doc" Wagoner of Westinghouse outlined the need for plant planning to obtain best production results, emphasizing not only "how" but "why" new equipment, flexible distribution and color coding promotes efficiency in industry. Using a miniature plant mock-up and cut-a-way exhibits, he discussed such items as the electric furnace, infrared driers, exhausts for fumes, steel seam welders and electronic controls and he urged the use of capacitors for raising the power factor in plants.

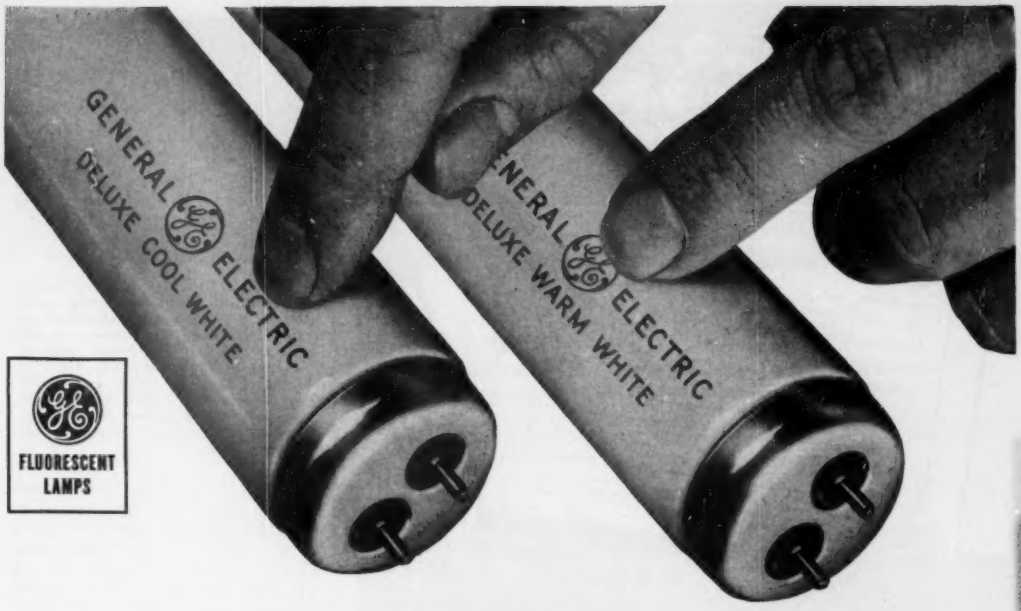
In the final technical session, D. P. Caverly, director of commercial engineering, Sylvania Electric Products, analysed many illumination installations to prove that "Good Industrial Lighting Pays". In mentioning the great variety of lamps and fixtures on the market, he said, "there are literally thousands of combinations of lamps and mounting methods for lighting a problem. One combination may be excellent for a particular job but definitely inadequate or undesirable in another situation. We, the manufacturers, have given you this wide variety of working tools but it is up to the lighting engineer to install and maintain them. Providing these tools and urging their proper use is our business but their actual application is your dream."

Closing the exposition, F. W. McGraw, chief electrician for the Union Switch and Signal Company, discussed the results of Planned Lighting in his plant during the past three decades, showing slides to reveal the progressive steps taken to gradually increase the plant illumination from 3 to 55 footcandles.

The executive committee for the exposition consisted of F. B. Mahon, Duquesne Light Co., general chairman; George Duerr, West Penn Power Co., honorary chairman; R. L. Whitney, Westinghouse Electric Supply, and Gordon Maize, Duquesne Light Co., vice chairmen; George Hartner, National Electric Products Co., space chairman; Bruce Fleming, E. L. Wiegand Co., program chairman; Don Potter, Westinghouse Electric Supply, publicity chairman; Rush Young, Pennsylvania Transformer Co., attendance chairman, and Byron Townsend, General Electric Co., arrangements chairman.

N. J. Electrical Group Elects Officers

The Essex Electrical League (New Jersey) has re-elected Earle B. Latham, vice president of E. B. Latham & Co., as president of the League for 1950. His running mates



FLUORESCENT LAMPS

General Electric announces two new white fluorescent lamps that bring out all colors!

NOW for the first time, you can have fluorescent lighting that gives near-perfect color rendition! The secret is a revolutionary new phosphor, "D-R", which, added to the inside coating of two new General Electric fluorescent lamps, transforms the effect of the white light they give. The new lamps—1) DELUXE *COOL* WHITE and 2) DELUXE *WARM* WHITE—show colors better than fluorescent ever could before, and at the same time offer you a choice of *cool* atmosphere or *warm*.

It's the greatest advance in fluorescent since G.E. introduced the first fluorescent lamp in 1938. And they'll give fluorescent lighting sales a big boost. These two new lamps will be available soon in 40-watt size, later in other standard sizes.

NEW WHITE LAMP LINE MAKES SELECTION EASY!

The whole question of *which* "white fluorescent lamp" to use is now simplified. The two new lamps—plus two "high-efficiency" lamps—create a line of four G-E white fluorescent lamps that fill practically every fluorescent lighting need.

STANDARD COOL WHITE (formerly 4500 white)—offers high efficiency with reasonable color rendition. Widely preferred for most working and selling areas.

DELUXE COOL WHITE—gives best possible color rendition with good (but not highest) efficiency. Recommended for areas where color rendition is most important.

STANDARD WARM WHITE (formerly Warm Tint) provides highest efficiency combined with color impression of filament lighting.

DELUXE WARM WHITE combines excellent color rendition with good (but not highest) efficiency. For warm environment where true color is essential.

FREE SELECTOR GUIDE shows which lamps you need to meet your lighting requirements. Write General Electric, Div. 166-EC2, Nela Park, Cleveland 12, Ohio.

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GENERAL ELECTRIC

Ramset Fastening System
Cost comparison sheet for Central Company
NO. OF FASTENINGS 1480
Present Method
Ramset System
TIME REQUIRED 365 HOURS 36.5 HOURS
COST AT $2.40 PER HOUR $876.00 $87.60
COST OF MATERIALS $148.00 $355.20
TOTAL COST $1024.00 $442.80
COST SAVED WITH RAMSET SYSTEM $581.20
57
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AT LESS COST

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compare your fastening costs... see what Ramset can save...

If you fasten or anchor work into steel, concrete, masonry or other hard materials, use RAMSET'S free Cost Comparison Sheet and see for yourself what you can save with RAMSET. Just fill in your figures and compare slow, costly, laborious drilling, chipping, plugging and tapping with lightning fast, simple, economical RAMSET FASTENING SYSTEM.

Less than a minute, from start to finish, is needed to set any one of 65 different RAMSET drive pins or threaded studs. Simply READY the light, portable RAMSET TOOL, place the tool against the work—and RAM! The fastener is SET instantly, tightly, easily!

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SAVES TIME . . . CUTS COST ON JOBS LIKE THESE:

Fastening—

- Electrical equipment.
- Wiring and conduit.
- Panelboards and controls.
- Lighting fixtures.
- Bus duct and outlets.
- Supports to concrete, brick and steel.
- Television antennas.

Stemco Corporation • Cleveland 16, Ohio

FASTEN FASTER, EASIER, CHEAPER WITH RAMSET

CONGRATULATIONS ***are in order to Bernard Heyrich (second from left), recently-elected president of the Maintenance Division of the Essex (N.J.) Electrical League. Others in the group are (left to right) Joseph Miserak, new treasurer; George Foxhill, 1950 secretary; retiring president Ed Krukiel, and newly-elected vice-president George Stotz.***

will be H. J. Hanbury, Westinghouse Electric Corp., vice president; Carl Schlaick, General Electric Supply Corp., treasurer; and Spencer A. Moore, Public Service Electric and Gas Co., secretary. Named to the executive committee are E. M. Lacey, Westinghouse Supply Corp.; J. A. Kennedy, Harvey Hubbell, Inc.; C. McKew Parr, Parr Electric Co., and Arthur Davis, A. L. Davis & Co.

The League's Maintenance Division will be headed by Bernard Heyrich, president; George Stotz, vice president; Joseph Miserak, treasurer, and George Foxhill, secretary. Committee members include Edward Krukiel, A. J. Jacobus, Bertram Barker, Frank Neubert, Stephen Tibus, John Davis and Joseph Powers.

One of several community projects sponsored by the Essex League this year was a large community Christmas tree, lighted by recently-developed pastel lamps. The committee in charge of this project included E. M. Lacey, chairman; Joseph Buhl, Ralph Morison, James Hanbury, Joseph Ward, Frank Pesveyc, Justin McCarthy and Frank Schmitt.

Study of an AW Operation to be Wiring Conferencce Feature

A workshop study of the St. Louis Adequate Wiring program will be a feature of the 1950 Wiring Conference. The study will be the first of its kind to be offered to Adequate Wiring leaders at a national meeting.

The workshop will take up the entire first day of the February 16th and 17th meeting in St. Louis. It will provide an opportunity to discuss and analyze every phase of a successful Adequate Wiring activity.

Carl Christine, secretary-manager of the St. Louis Electrical Board of Trade, will preside over this section of the conference. He will explain how all local groups work together to attain their objective. And he will introduce various industry members who are active in the program. Presentations will be made by builder contact men, a home service adviser, a layout man, a city inspector, an advertising man, an electrical contractor and a builder. The workshop will conclude with a field trip to two residential developments, in different price brackets, which are featuring certified Adequate Wiring.

General chairman of the conference will be A. H. Kessler, secretary-manager of the North Central Electrical Industries.

The conference will also feature an open forum discussion—usually one of the liveliest sessions at the annual meetings—plus other subjects of interest to Adequate Wiring leaders.

The conference is open to all who are interested in the promotion of Adequate home wiring. Electrical contractors, dealers, manufacturers' representatives, utility and league personnel are urged to attend.

Contractors Share T-V Contract

Of interest to electrical contractors is the recent concerted action by a group of New York City realtors who are jointly installing over 1000 T-V outlets in three large apartment projects. Wiring for the three RCA Antenaplex systems and the installation and connection of all T-V equipment will be done during construction by the same electrical contractors who are installing the light, power, telephone and signal systems in each of the buildings.

The electrical contractor for the largest of the three projects (Schwab House at 11 Riverside Drive with 700 T-V outlets) is the Spitzer Electric Company, while the remaining two apartment houses will be handled by the Consolidated Electric Company (contractors for the 40-44 Park Avenue project) and the Regent Electric Company (contractors for 715 Park Avenue). T-V equipment and engineering services are being furnished by the Commercial Radio-Sound Corporation, metropolitan distributors for the Radio Corporation of America.

The systems will consist of a television outlet in each apartment, ready for plug connection of any standard television receiver, providing all outlets with all-channel reception. In addition to providing interference and

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FLOOR BOXES — WIRING SPECIALTIES

Economical and Efficient

"Latrobe" Floor Boxes and Wiring Specialties offer double economy: through speedy installation, through dependable performance.

They are made of quality materials, and through simplicity and straightforwardness of design, they make installation easy and long, efficient service a fact.

NO. 252-R TWO GANG ADJUSTABLE FLOOR BOX

This No. 252-R Two Gang Box is adjustable and has our No. 200 Receptacle in one section. One Cover Plate has ½" Flush Brass Plug; other has 2" Flush Brass Plug.

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Sturdy and dependable for hanging pipe or conduit ½", ¾", and 1" to steel beams up to ⅝" thick. Larger sizes for larger pipe.

NO. 280 NOZZLE
NO. 200 COVER PLATE

10 Amp. 250 volt Receptacle in Brass Housing, mounted on ½" brass pipe extension 3" long. Longer extension if desired.

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The neat compact design of the No. 110 Box quickens installation time and makes for smooth, trouble-free service. 200 Receptacle. Cover Plate is 3½" diam.

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MANKATO, MINNESOTA

ELECTRICAL CONTRACTORS *who will install RCA television Antenaplex systems in large New York apartment projects discuss plans with manufacturer and distributor executives at meeting in N.Y.C. Left to right; S. W. Hurowitz, Consolidated Electric Construction Company; Alexander Fisher, president, Commercial Radio-Sound Corporation; Edward Kestenbaum, Regent Electric Company, and W. W. Watts, vice president in charge of the RCA engineering products department.*

reflection-free reception to tenants, the systems will eliminate the erection of individual antennas, will promote the appearance of roof-tops and will reduce maintenance costs.

Conceding that separate antennas for individual tenants of large multi-family dwellings are impractical, unsatisfactory, unsightly, uneconomical and subject to interaction when located in close proximity to each other, owners and tenants are becoming increasingly interested in master systems that will provide good reception on all television channels serving an area to all tenants desiring the service.

Prior to the signing of this joint contract the installation of master systems was retarded by relatively high unit costs and the lack of feasible financing plans for inducing owners to invest. However, a recent ruling of the Federal Housing Expediter now considers a master television antenna system a capital investment subject to the Fair Returns provision of the rent law, making it possible for an owner to safely invest in such systems with the reasonable assurance of an adequate return through increased rentals or direct charges to tenants using this service.

The action of the New York group is an outgrowth of joint deliberation and planning and is believed to indicate a trend among realtors towards making master systems available to the millions of metropolitan apartment dwellers already owning or contemplating the purchase of T-V sets.

At the time of signing the contracts, Frank M. Folsom, president of RCA, said that the concerted action of the three apartment owners is believed to

be the first in which realtors have joined together to solve the T-V reception problem. Participants at the meeting, in addition to Mr. Folsom, the apartment owners and their rental and management agents, included Edward Kestenbaum of the Regent Electric Company; Samuel Hurwitz, president of the Consolidated Electric Company; Edward Sears of Sears and Kopf, and Julian Roth of Emery Roth and Sons, engineers for Schwab House and 40-44 Park Avenue, respectively, in collaboration with the Commercial Radio-Sound Corporation; Alexander Fisher, president of the latter firm, and W. W. Watts, vice president in charge of the RCA engineering products department.

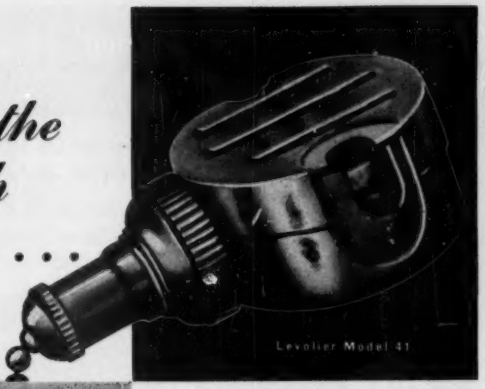
As explained by Mr. Watts, the RCA Antenaplex system consists essentially of a rooftop array of antennas, matching in number the channels on which service is available at the point of installation, a master signal amplifier boosting the strength of signals received on each channel, and a network of coaxial cable carrying signals on all channels to outlets in all apartments or other units of the building. Each system is engineered to meet field conditions and each antenna is individually tuned to a particular channel. In addition, each receiver is completely electrically isolated from all others in the system, insuring maximum signal strength and eliminating "ghosts" sometimes caused by signal reflection from other buildings. Interference from signals coming in on other channels is also minimized.

With seven channels in use in the New York area, each installation will include seven antennas individually tuned. In addition to better reception and the elimination of excessive roof construction, a single cable will carry programs on all channels to a large number of outlets, simplifying wiring and reducing installation costs.

Book Reviews

Rewinding Small Motors

Motor repair men will find a wealth of useful information in the third revised edition of "Rewinding Small Motors" written by the late Daniel H. Braymer, formerly editorial director for the *Industrial Engineer*, and A. C. Roe, manufacturing engineer, Westinghouse Electric Corporation. All types of hand and machine-wound winding jobs are discussed from start to finish, clearly illustrated by wiring diagrams, photographs, tables and charts. Information on new materials, methods and processes are included, with attention directed to such procedures as using some new types of



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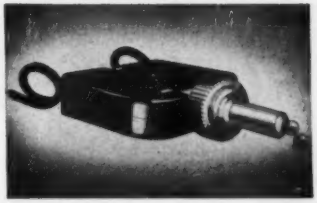

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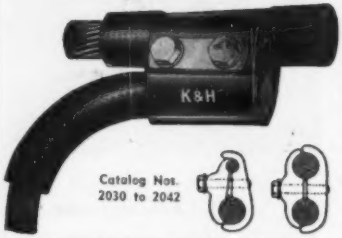

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The tightening bolts exert an even pressure on both wires regardless of size. The clamping surface is large and covers a contact area several times greater than the cross-section area of the wires themselves. Locking feature insures a permanent connection.

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windings and using the new back, single-loop, high-speed lathe winding. Silicone materials, glass insulation and Formex type wires are described and analysed as to application, and the fundamentals for scheduling the rechanging of small motors are discussed in non-technical, easily-understood terms.

Including sections on both a-c and d-c motors for such diverse items as portable drills, grinders, automobile starters, sewing machines, fans, vacuum cleaners and bench tools, this practical how-to-do-it manual contains 422 pages, sized 6-by-9 inches. It is priced at $4.50 and is published by the Mc-Graw-Hill Book Company, New York, Toronto and London.

National Electrical Code

The 1949 printing of the National Electrical Code incorporates all amendments to the 1947 Code, clearly marked to indicate where changes have been made. Printed as footnotes under the Code paragraphs to which they apply are all official interpretations through June 1, 1949, clearly explaining those sections which have prompted questions by users and inspectors. With the Code, Code revisions and official interpretations printed under a single cover, the inconvenience of having to refer to separately published material is eliminated, and an index of all other standards related to the Code makes it easy to evaluate Code rulings for structures of special occupancy. Attractively bound in a 6-by-9 inch red cloth volume and containing 420 pages, this Fifth Volume of the National Fire Codes is priced at $3.00 and is published by the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass.

Dates Ahead

Plant Maintenance Show and Conference—Auditorium, Cleveland, Ohio, January 16-19.
American Society of Heating and Ventilating Engineers—Dallas, Texas, January 23-27.
Southwest Air Conditioning Exposition—Dallas, Texas, January 25-27.
American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 30-February 3.
Industrial Electrical Equipment Exposition—Annual exposition, sponsored by Electric Maintenance Engineers of Milwaukee, Wis., Feb. 2-3.
National Electrical Manufacturers Association—Edgewater Beach Hotel, Chicago, Ill., March 13-16.
American Society of Tool Engineers—Industrial exposition, Convention Hall and Commercial Museum, Philadelphia, Pa., April 10-14.
Chamber of Commerce—38th Annual meeting, Washington, D. C., May 1-4.
National Fire Protection Association—54th Annual Meeting, Haddon Hall, Atlantic City, N. J., May 15-18.
National Industrial Service Assn.—Annual meeting, Boston, Mass., June 5-7.
National Association Electrical Distributors—Annual convention, Atlantic City, N. J., June 12-16.

ELECTRICAL SYSTEM PROMOTES SAFETY

[FROM PAGE 63]

pletely electrical, with lighting, heating, cooking and hot water provided in the complete absence of chimneys, gas connections or buried steam mains. In the central heating plant, oil burners also rely upon electrical power, while many segregated areas are warmed by unit heaters.

Reliable as the a-c electrical system has proved, safety dictates the inclusion of an auxiliary d-c system for the hospital, school buildings and auditorium, with automatic throw-over switches to place these areas on battery service in case of an a-c failure. In these locations, where interruption of power could create hysteria or other emergencies, the importance of service continuity cannot be overstressed.

Another commendable feature associated with the electrical installation is its importance as a training tool in the institution's occupational therapy program. For many of the handicapped students (under competent supervision) assist in the maintenance and operation of the school which, in the case of the electrical department, includes such activities as cleaning and relamping lighting units, simple wiring, the installation of electrical equipment and controls, or repairing some of the school's 500 motors. By so training students to live as happily and purposefully as their limited mental capacities permit, the school is compiling an impressive record of rehabilitation—a record which shows that, since the establishment of the institution, more than 300 of the 2,000 students have been returned to society and, during the past year, these productively-trained persons collectively earned more than $100,000 in wages.

Inasmuch as the institution primarily houses children, conditions approaching those of a normal community and home have been sought and achieved. Nothing of the traditional institution aspect is present and, designed to duplicate in appearance and character a typical New England village, this 5-million dollar 1500 acre project includes a modern and complete town hall, hospital, large school, administration building, 30 brick Colonial cottages for housing the children, attractive homes for supervisory personnel, a heating and power generation station, laundry and maintenance shops, village green, farm and carefully laid out and lighted streets and driveways.

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COMPLETE 5-LAMP ASSEMBLY
USE THE AUSTIN ALUMINUM CLUSTER LIGHTS!
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6 tapped holes, 2 plugged. Built-up center post keeps screw from wires. Self-centering hole in post for easy screw insertion.
COMPLETE 3-LAMP ASSEMBLY
3 No. CLU-150 Lamp Holders with CLUA-3 Terminal Box
2 INCH POLE FITTER
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Slip fit adapter for 2" pipe, with set screw and ½" close nipple.
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For upright or horizontal position—one, two, or three lamps. Can be used on top of CLU-5 splice box for 7-lamp combination.
CLUA-3
CLUSTER LAMP HOLDER WITH ASBESTOS GASKET FOR PAR-38 LAMPS
150 Watt all-aluminum lamp-holder. Back plate easily removed for socket replacement.
CLUSTER SPLICE BOX FOR 7 LAMPS
CLU-7
Body with 7 drilled holes, 5 in top and 2 plugged in back.
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in the modern power house at 2300 volts, 3 phase, 60 cycles, by two 375-kva. and one 625-kva. Crocker Wheeler generators directly connected to turbines receiving steam at 275 psi. with 500 degrees of superheat from a bank of 4 oil-fired 400-hp. Titusville water tube boilers; these boilers also providing steam for the underground network of heating tunnels, the supply of hot water and the operation of laundry washers, dryers and pressers.

Switching equipment is contained in a 12-cubicle dead-front switchboard, with trunk breakers included on the eight outgoing feeder panels controlling the underground loop distribution system. Distribution voltage is maintained at 2300 between power house and the 25 transformer vaults (containing 40 transformer units) located strategically at segregated load centers where current is stepped to 120/208 volts for utilization.

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Under the supervision of Ernest N. Roselle, who served as Technical Advisor to the 7-member State-appointed Commission during the planning and construction period and who has directed all institutional activities as Superintendent since that time, Southbury Training School is already recognized as a model institution dedicated to the rehabilitation of mentally deficient children. As such, it is proving to other states and other nations that safety and industrial training can be constructively furthered through the intelligent adoption of the electrical industry's many modern contributions.

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ELECTRICAL INSPECTION CONTROL

(FROM PAGE 56)

service switch in accordance with the recommendations of Sec. 2357 of the 1940 N.E.C. Code. When the 1947 edition of the N.E.C. was adopted in December 1946, the above rule was changed to include Sections 2304 and 2357 making No. 6 service conductors as well as the 60-ampere switch the minimum requirement. Enforcement of these measures met the problem of lower capacity installations and has now been completely accepted by the public and electrical industry.

At this time, serious thought was given to methods of effectively controlling larger capacity services and feeder systems for commercial buildings. To accomplish this, we developed a blank plan (wiring diagram) which could be readily completed to fit most jobs between the minimum required service and the large projects which have the benefit of complete engineering and detailed plans. At first, a mimeographed sheet was used on an informal basis.

The success of this trial led to another change in the inspection policy. In February 1947, provisions of Sec. 2205 of the 1947 N.E.C. (requiring diagram showing feeder details) were made to apply to all new and remodeled wiring systems, except single and two-family residences. *Permits to begin work (and permission to connect energy) would not be issued until the plan was filed and approved.* Plans could be so easily prepared from the blank (an 8½-in. by 11-in. printed form) that no excuse for delay was possible. Following more than two years of experience, the procedure has become a matter of course.

The pre-permit blank plan system can be improved and we are trying to work in the addition of branch circuit number and sizes without complicating the sheet. It is important to keep it as simple and direct as possible.

Contractors, as well as the inspection department, have benefited from this system. The policy of requiring a definite plan based on Code rules has removed the suspicion that competing contractors will be permitted to install an inadequate electrical system. Almost no complaints of unfair competition have emanated from contractors since the adoption of this policy. Before that, complaints were frequent. Many contractors have also found the blank plan a convenient job estimating record and work sheet.

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Industry is now planning to invest $12.4 billion in new plants and equipment in 1950. This is 13% less than industry—as represented by manufacturing, mining, transportation, and utilities—actually spent in 1949.

Industry's 1950 plans, however, may well bring investment during the year to a point slightly above its current level. This survey, plus government surveys on capital expenditures in the first quarter suggest that the steady decline in capital expenditures from their postwar peak at the end of 1948 is probably over.

These are the major conclusions of McGraw-Hill's third annual survey of business' plans to invest in new plants and equipment. Conducted by the McGraw-Hill Department of Economics, the survey summarizes the investment plans of responsible business leaders in all industries.

The survey shows:

(1) Manufacturing companies as a whole plan to spend $6.3 billion in 1950 for new facilities.

(2) Manufacturers as a whole expect 1950 sales to about equal 1949's volume.

(3) Manufacturing capacity will be increased about 3% during the year—under present plans.

(4) The bulk of manufacturers' investment funds, 65%, will go for replacement and modernization of existing facilities. This continues the shift in emphasis away from expansion reported last year.

(5) Internal sources—retained earnings and depreciation reserves—are counted on to provide more than nine-tenths of capital funds in the manufacturing industries.

(6) More than half, 56%, of all manufacturing firms report they would not reduce their investment programs even if general business should decline 20% during the year. However, two out of three firms review their investment programs monthly, and most of the others look them over at least once a quarter.

(7) They would *not* increase their 1950 investment programs, say more than 90% of the manufacturing firms, even if they could sell new common stock at a price 50% above its November, 1949 price.

(8) Investment plans in other industries also show a 13% decline in 1950 from 1949. This coincidence arises from the fact that utility companies, notably the electric light and power companies, will spend only slightly less than they did in 1949. Railroads, on the other hand, will cut their 1950 expenditures by 44%.

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POWER MODERNIZATION [FROM PAGE 57]

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The largest substation, No. 2, is rated 600 kva. The metal enclosed switchgear (Fig. 1) serves the Feldspar and Smelting rooms. The office and main laboratory each have a 600 ampere air circuit breaker protecting their systems. A 400 ampere breaker feeds the Antimony department.

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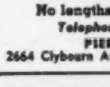

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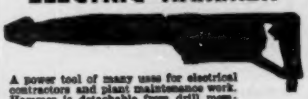

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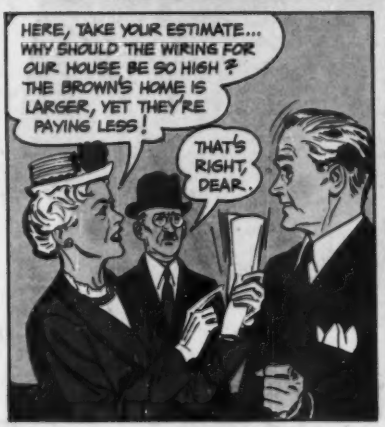
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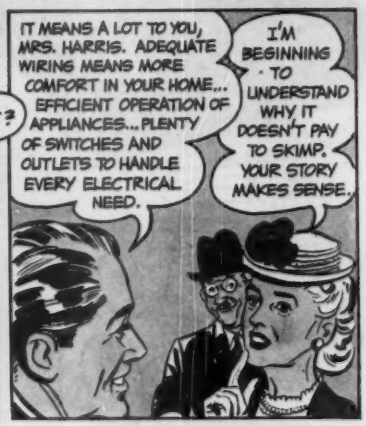
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